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IMPROVED PUMPING ENGINE FOR WATER WORKS.

We illustrate herewith one of the smaller sizes of an improved duplex pumping engine for water works, manufactured by Messrs. Dean Brothers, of Indianapolis, Ind. The steam cylinders are 16 inches in diameter, water cylinders 10 inches in diameter, and the stroke 16 is inches. The machine is capable, we are informed, of delivering 1,000,000 gallons in 24 hours; or when connections are made with hose to different hydrants, it will throw four 1½ inches streams to a hight of 130 feet, which is sufficient for towns with from 5,000 to 8,000 inhabitants. The manufacturers construct much larger engines of the same description, capable of delivering 6 000,000 gallons in 24 hours, or throwing twelve fire streams from the mains, all working equally well in connection with the reservoir, the stand pipe, or the direct pressure system of supply. Steam is used expansively, and the larger engines are provided with adjustable cut offs. The crank shafts are connected together by a coupling, and the cranks are set at right angles to each other, so that they may run very slow without stopping, or may maintain a high speed without injury. All bearings have large areas, and have means of adjustment in case of wear; the water cylinders are lined with copper; the valve seats are made of gun metal with noiseless rubber valves, and the larger sizes of pumps have hand holes for examining or removing the valves. The piston rods are of steel, and the water piston rods are covered with brass. The crank shafts are made of hammered iron, the crank pins of steel, and the cranks of cold blast charcoal iron. Every part is made of the best material, carefully fitted. All the pipes are carried under the floor, as shown. The steam supply pipe is carried into the bottom side of the steam chest, and the exhaust pipe leads down between the pumps. The suction pipe, which is brought up between the water cylinders, has a vacuum chamber attached, which is represented between the wheels.

All the pipes being out of sight gives the engine room a very neat appearance and insures a dry floor. In front of the steam cylinders are three throttle valve stands; the center one is for running the pumps duplex, the others are for running them separately.

An important feature of this duplex pump is that it may be converted into two single pumps by uncoupling the crank shaft, which can be done very quickly. By closing the valves on one pump, the other may be run alone. This is a point of considerable advantage, especially where direct pressure is used, as the supply would be interrupted if the engine were stopped for a few minutes, and a fire might occur at the very time the engine is at rest.

We learn that this machinery has been in constant operation at Union City, Ind., night and day, for over two years, without stopping, and has never cost a dollar for repairs. The supply is there kept up by pumping directly into the mains, and in case of fire the hose is attached to the hydrants.

The following cities are also using the duplex pumping engines, which furnish the entire supply of water for fire and domestic purposes: Peoria, Ill.; Alton, Ill.; Charleston, Ill.; Brazil, Ind.; Attica, Ind. It is claimed that the engines in Peoria are showing a saving of 35 per cent in fuel over the machines previously used. And in all the other cities the machines are working with great economy, no fire engines being employed, the hose being attached directly to the hydrants. The manufacturers (whose address is at junction of Delaware street and Madison avenue, Indianapolis, Ind.), also make an excellent variety of steam pumps for general purposes.

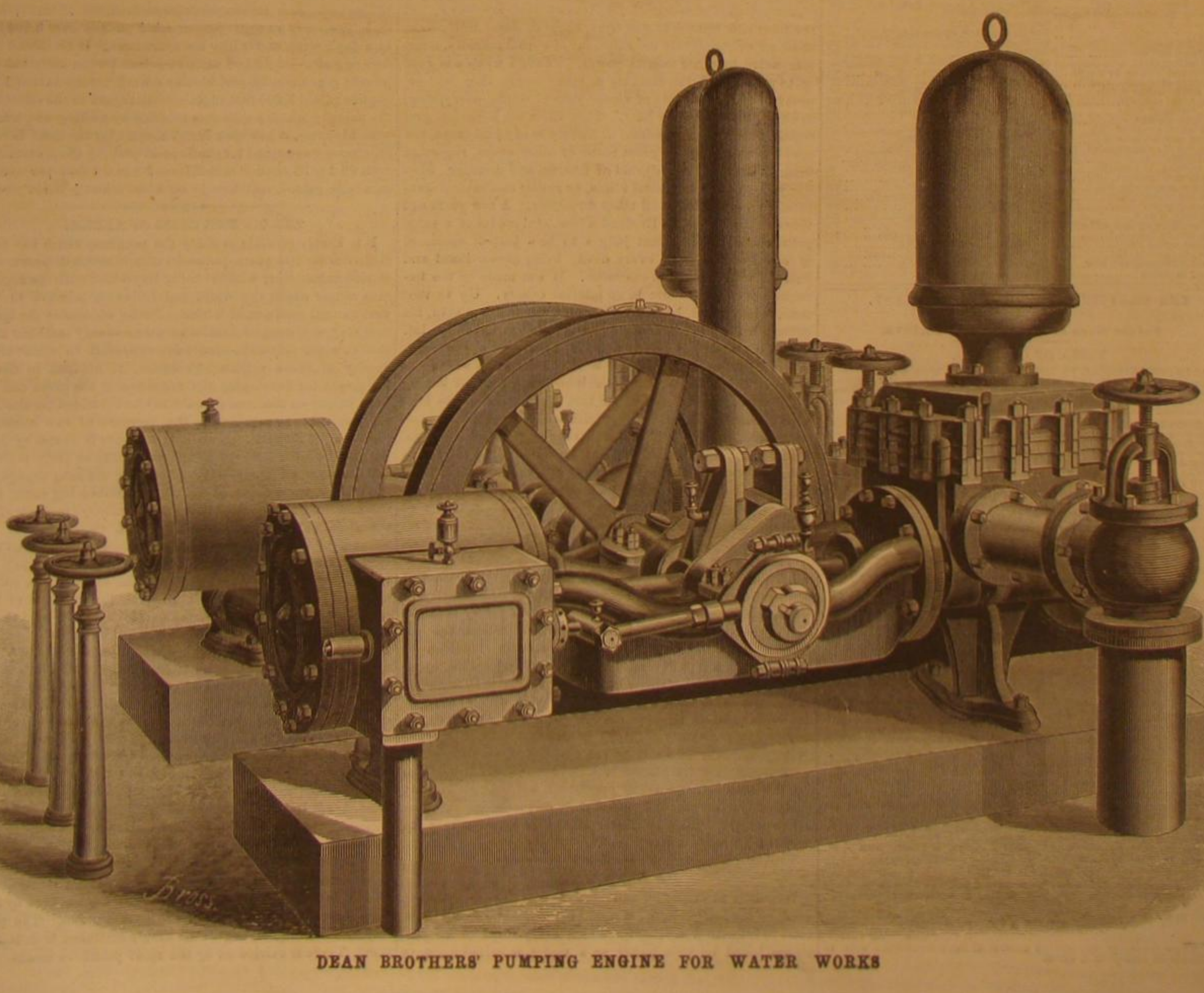
Are Nitrites in Water Caused by Bacteria?

It has generally been supposed that, wherever nitrites were found in spring or well water, they were formed by the oxidation of the ammonia. Mensel has recently proved that, in many cases at least, the nitrates were converted into nitrites through the action of bacteria. The following facts sustain this theory: Well water containing no ammonia, and, when fresh, no nitrites, but some bacteria, after standing a fortnight gave the reaction for nitrites. In this case, the nitrates were the only nitrogenous compounds in the water when it was fresh. Salicylic, carbolic, and benzoic acids, alum and table salt, in short all antiseptics and antizymotics, hinder or retard the formation of nitrites. Water containing nitrates, did not, in the presence of bacteria, produce nitrites; they appeared in from 2 to 14 days after adding some carbohydrate, as sugar, gum, or starch. A few other carbonaceous compounds convert nitrates into nitrites, but slowly and weakly. Antiseptics stop this decomposition.

Freshly distilled water, boiled with sugar and saltpeter, and sealed up while boiling, contained no nitrites after standing for weeks, because no putrefaction can take place without bacteria. Putrefying albuminous substances, brought into contact with nitrates, yield nitrites.

We do not get a correct view of the decomposition going on in wells rich in saltpeter until we look upon the nitrous acid as the direct product of decomposition. The decomposition of cellulose by means of bacteria, in the presence of nitrates, proves that saltpeter is not only direct food for the plant, but, owing to the oxygen in it, performs an important function in the soil. The decomposition process above described is a very extensive one, and elucidates the decay of plants, as well as many other operations in factories. The alkaline nitrates by themselves are not so easily reduced and if, nevertheless, the microzoa employ their combined oxygen for oxidation, there is an important difficulty in regard to the power of bacteria, because on the one hand they produce oxidation, on the other they deoxidize.

This fact may lead to a new method of combating diseases which are related to bacterian organisms.



DEAN BROTHERS' PUMPING ENGINE FOR WATER WORKS

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WHAT THE COMING MAN MAY BE.

Clever writers have frequently amused themselves and their readers by forecasting the future, and prognosticating the condition of humanity centuries hence. They have materialized, so to speak, the dreams of to-day, and pictured human life as it might be were those dreams fulfilled. In all these Utopias, however, the people, though better morally, more happy socially, more fortunate politically, and more powerful through easily predicted increase of knowledge, are yet substantially the same as the people of the present. It is assumed, apparently, that the future progress of man is to be measured by changes in his condition, not by changes in himself: that, supposing progress to go on in the future as in the past, the men of 5876 will differ from us in their personal development.

A writer of sufficient knowledge and liveliness of imagination might plan a more marvelous and, it is hardly too much to say, more probable Utopia from the standpoint of psychical rather than material development, picturing a time when the average man will be intellectually as superior to us as we are superior to the less developed man of five thousand years ago. That there has been a similar increase of human brain power during the past few thousand years is as certain as that there was a steady increase of brain bulk throughout the animal kingdom during the geological ages just preceding; and there is no physiological or other reason for believing that man may not go on perpetually increasing in mental power.

Measure the intellectual gulf between the Australian savage, barely able to count his fingers and having no numerals above two, and a Newton or a La Place, or even the average man of to-day: then suppose the whole race advanced an equal interval. Imagine a race of men so intellectual that the average man would be a Michael Angelo! The basis for such an estimate of the powers of the coming man is found, strange to say, in certain idiots.

Idiocy is commonly marked by the non-development of the physical powers, but sometimes by the non-development of all but one, in which cases a single faculty appears to receive the whole of the force evolved, and to develop enormously at the expense of all the rest. Thus we may account for the marvelous power in one direction shown by idiotic prodigies like Blind Tom, whose psychical power is wholly musical. The idiot painter known as Cat Raphael illustrates the same perversion of force in another direction. He drew and painted cats and kittens of every sort, shape, and shade, in every possible position and condition, and painted them wonderfully well, yet could do nothing else. In like manner we have calculating idiots, able to make the most elaborate calculations almost instantly but utterly unable to explain the mental operations involved. Other idiots, without reference to clock or watch, and without conception of the object or meaning of divisions of time, are able to tell the hour and minute at any time, night or day. Still others show an extraordinary development of verbal memory, unaccompanied by other mental power. Though unable to read or to understand the meaning of many words, they will repeat by sound hundreds of verses, lists of words, everything, in short, that they may hear. Then there are historical prodigies, who, though ignorant of history in any just sense, can give the date of every great battle or other event, repeating them as isolated facts, devoid of interest and meaning. Similarly there are mechanical idiots, or rather mechanical geniuses who are idiots in all other directions. A few years ago there was exhibited in England a beautiful model of a ship, pronounced by competent judges to be a perfect specimen of naval architecture, every detail being proportioned and finished with the nicest exactness. It was made by the imbecile son of a gardener in an interior county. Up to that time, it is claimed, he had never seen the sea or a ship, his pattern being a printed ship on an old pocket handkerchief. When his work was nearly finished, he visited a dockyard, and made a few changes in his work. Four years were spent on this, his second attempt at shipbuilding, his first having failed through ignorance of the fact that wood could be bent after immersion in hot water, a trick which he is said to have discovered by himself. He was taught to copy drawings, which he did with surprising exactness; yet after all, at the age of twenty-four he was described as a small headed, large pupilled idiot. So we might go over the whole list of human faculties, finding illustrations of enormous developments of each combined with the total lack or non-development of all other mental powers. The entire force of such individuals seems, as we said, to be turned into a single channel.

Imagine an organism capable of sending an equal amount of force to each and all the faculties: a type of humanity in which the average man should have the memory of some idiots, the swift and certain calculation of others, the linguistic, musical, constructive, and artistic faculties of others. Such a type of man is by no means impossible, by no means improbable. There have been prodigies in memory, in calculation, in music, in inventive power, who were up to the average in all other directions. However excessive the development of their faculties in one direction, it did not greatly impoverish them in the rest. And as, during the milleniums past, the human race has been slowly lifted from the low intellectual level of prehistoric savages, so we may reasonably infer that the race will go on increasing in mental power, until those prophetic hints of what man may be are all achieved and overpassed.

A MAN'S WORK.

How best to utilize human labor, and at the same time to produce the least fatigue, is one of those interesting problems in industrial mechanics which every inventor of machines based on man power as a motor is called upon to consider, and to which every employer of men for the sake of their brute muscular strength is obliged to give some attention. It is a common error to believe that, in order to produce a given amount of work, a man always expends a given amount of power, and to recognize this is the first step toward a correct estimation of a man's muscular capability. Appropriate rests are absolute necessities to the human machine, and it is by intermittent, not continuous, effort that its best work is produced. One man laboring ten hours and taking intervals of repose will produce more force and accomplish more work with less fatigue than another laboring eight hours with shorter or less frequent rests, the actual time spent in working in both cases being equal. But on the other hand, during the periods of absolute work regularity is a necessity, a fact clearly shown by the government of soldiers on long marches, where the drum to which the feet keep time is a wonderful agent for repressing fatigue, simply because it ensures regularity of motion. So also in rowing in a long race experience has proved the advantage of a clockwork regularity of stroke with a brief breathing spell between each pull. In fact it appears that men will naturally fall into this cadence, as witness the blows delivered by laborers with sledge hammers upon rock drills, and the peculiar timed "hup" which each will aspirate as his implement falls, or the tendency which sailors have to break into a cadenced singsong when pulling a standing haul on a rope. A more curious instance in this same regard is found in the power of dancing; nothing but the repeated rests and the regular movements will explain the ability of women, to whom ordinarily a walk of a mile in length is a severe task, to dance during a period of five or six hours, and this at a time when Nature is most exhausted, owing to deprivation of sleep.

The best application a man can make of his power is through his legs, for the muscles of those members are not only absolutely but relatively stronger than those of the arms. In other words, after work, the fatigue produced in both sets of muscles being equal, the leg muscles will have performed more useful labor than those of the arms. And further, the nearer we imitate a natural movement the better do we apply the power, therefore a walking motion of the legs, at a velocity equal to that of an ordinary gait, and applied to levers, is probably the most efficacious application of human force for steady work.

As to the absolute power of a man, expressed in pounds to be lifted or in similar terms, exact data are obviously impossible, even for an average individual. An interesting series of experiments were conducted on this subject some time ago in France, and these, we believe, give a fair approximation. The heaviest load a man of strength can carry for a short distance is placed at 319 pounds. All a man can carry habitually—as a soldier his knapsack—walking on level ground is 132 pounds, and this is an extreme load, we should judge. Or he can carry an aggregate of 1,518 pounds over 3,200 feet as a day's work, under like circumstances. If he ascend ladders or stairs—as do hod carriers—then he can carry but 121 pounds continuously, and his day's work cannot exceed 1,232 pounds raised 3,200 feet high. With regard to the effort and the velocity which a man can produce by pulling or pushing with his arms, it has been found that, under the most favorable circumstances and for continuous work, an effect exceeding from 26·4 to 33 pounds raised from 1·8 to 2·1 feet per second cannot be gained, and this is equal to about $\frac{1}{8}$ horse power.

THE OIL RESOURCES OF AFRICA.

It is hardly possible to study the progress which has been made during late years, in the art of utilization of previously wasted substances, without being impressed with the anomalous course which the world has followed, relative to the vast natural products of Africa. To the economist the question may well suggest itself whether an energy and skill akin to that which scientific men have expended in discovering sundry of these utilizing processes, if devoted to devising means for developing the resources of the great and almost unknown continent, would not have yielded results far more valuable to mankind in the increase of raw material placed at its disposal. A striking instance is found by comparing the labor devoted to the extraction of fatty matters and grease of all kinds—labor (including the long voyages of the whaler, the sinking of wells in the oil-bearing earth, and the manifold operations known to chemistry) dependent on countless varying circumstances—with the fact that for miles along the West Coast of Africa, extending between Cape Blanco and St. Paul de Loando, there are vast forests of palms, the oleaginous fruit of which has for centuries rotted unused upon the ground. The palm forests back of the coast line between Cape Palmas and Elmina are said to be practically inexhaustible; and so also, in the neighborhood of Fernando Po, immense tracts are covered with the trees. The total export of the palm oil to England exceeds, it is said, 50,000 tuns, or a value of $10,000,000 per annum; but it will readily be seen that this represents an exceedingly small commerce compared to what might be the case were the enormous resources fully or even moderately utilized. The Fernando Po oil crop, as an example, seldom equals 400 tuns per annum, although 4,000 might easily be produced.

The difficulties in the way of the development above indicated are the unhealthiness of the country, and the monopolies controlled by slave dealers. One of the latter buys the entire right to a large and valuable region by paying the King of Dahomey $10,000 a year. The iniquity of this monopoly is increased, says a recent writer, by the king binding all he traders to give palm oil to this trader at a price fixed by this king himself, without reference to market prices. The penalty of non-compliance with the king's command is decapitation. Trade is carried on by the most primitive means. In

Bonny, which is now the greatest palm oil market on the West Coast, the manila, a bronze coin from Birmingham, England, not unlike a bracelet in shape and size, is the current medium for money; in Old Calabar, the currency is copper wire and brass rods, about three feet in length and bent double; on the Guinea coast, gold dust is used, and one tribe uses strips of iron tied up in bundles of eight or ten pieces.

The fruit from which the oil is obtained grows in the form of a large cone, about the size of a man's hat. It is covered with long spines which protect the nuts, the latter being about the size of a large olive and of a deep golden color. The palm tree forests, in the midst of which most of the factories exist, are said to be very picturesque. The trees, which tower to an enormous hight, are as thick as it is possible for them to be, forming in some places large and impassable clumps, and in others opening in wide and tortuous vistas. The trunks are often covered at the lower part with tufts of lovely fern, the emerald green of whose long fronds, as they droop gracefully to the earth, forms a beautiful contrast to the somber brown of the trunks which they ornament. In the open spots in the forests, the factories, mere collections of huts, are built. In Dahomey, the nuts, when gathered, are thrown into a trough formed by marking off a small area about six feet square, beating down the earth to form a floor and enclosing it in a wall about 18 inches high. Into this receptacle the husks are thrown, to be trodden under foot by women until the husks and the oil which exudes together form a kind of putty. The mass is then thrown into vessels of hot water, when the oil rises to the top and is skimmed off. In Fernando Po, it is the practice to let the nuts rest in heaps until almost putrefied; hammering with stones follows, and then simmering of the pulp in a kettle, after which the women squeeze out the oil with their hands. The men do not engage in the manufacture, their labor ending with the climbing of the trees and shaking down of the fruit. It will be observed that the outside of the nut only enters into the process. The kernel separately yields a so-called black oil, and forms the staple of a trade with England, where the hard portion is subjected to the action of powerful crushing machines.

Oil from the palm nut, is, however, by no means the only fatty product to be obtained from rank African vegetation. No one has ever estimated the vast resources of this description, which abound in the countries bordering on the river Niger; and it is only in the shape of experimental and comparatively small exports that we get a glimpse of them. From Senegambia and Guinea come Touloncuma oil, used by the natives for anointing their bodies, and for burning in lamps, and Galam oil, a natural vegetable butter very much used in Africa for preparing food. The castor oil plant grows wild with great luxuriance in Senegambia; and throughout West Africa there is an immense yield of pea or ground nuts, which already has given rise to a large commerce. In the northern part of the continent and especially Algeria, there are enough olive trees to supply, if fully developed, the demand of all Europe. The province of Kabyle is one enormous olive tree forest. The cocoanut palm grows in immense forests in Zanzibar, where its fruit is exported to France and England, for making stearine for candles. The *trichilia capitata* on the Zambesi produces small black seeds which contain a large quantity of solid fat. The "forna" nut of Central Africa yields an excellent oil for culinary purposes, and is cultivated by the natives. A tree discovered by Dr. Kirk on Lake Nyassa also gives a rich oil, which even the natives have not utilized.

There is no doubt but that, in the gradual progression of commercial colonies for the development of the resources we have indicated, the most rapid means for opening up the interior of Africa, will be found. Such expeditions as those of Stanley and of other isolated explorers, though they may add to our knowledge of other resources, do nothing toward their utilization, but rather only show us how great is the task which civilization sooner or latter must accomplish, in overcoming the natural obstacles of a neglected continent.

ANOTHER NEGLECTED INDUSTRY—MUSHROOM RAISING.

We have never been able to understand why mushrooms are such an expensive delicacy in this country. Every variety of the toothsome fungus—even the Italian mushroom, the most delicious of all—grows wild in our pastures or can be raised in our climate with very little care. And yet, those who most use mushrooms, the hotel and restaurant proprietors, buy the French canned goods, save for a short time in the autumn when a small supply of fresh mushrooms are obtainable. French mushrooms cost all the way from 50 cents to $1 for a little can, at retail; and to buy a small basket of fresh mushrooms, even in our large markets, is rather to overtax the average pocket. Still we have picked them by the pailful in Connecticut cow and horse pastures; but the natives looked askance at our eating them; and as to cultivating the "toadstools," the idea to their mind was preposterous.

Now, with all due deference to our excellent farmers who think as above, we venture to affirm that, if a few of them would set about this cultivation on a large scale, and offer the products in the cities, they would find a ready sale, and realize quite a large profit. Occasionally a florist makes a mushroom bed in his greenhouse, and lovers of the delicacy sometimes cultivate it in a small way in their conservatories and cellars; but with the exception of the effort made by the late Professor Blot, that prince of French cooks, who came to this country as a missionary to reform us from dyspepsia-breeding pie and fried meat, we know of no attempt being made here at their cultivation on a commercial scale. The professor built wooden structures under ground, and they decayed; then he grew tired of his project and let it die through neglect, before any of its results, good or bad, could be seen. Near Paris, Blot had seen immense caves, from 20 to 60 feet in depth, filled with mushroom beds, the length of all of which beds together in one year aggregated over 21 miles; and he knew well that often a single building stone quarry, in the excavations of which the beds were located, sent 3,000 pounds of mushrooms daily into the French metropolis. No wonder, then, seeing the utter absence of the fungus from our markets, that he perceived an opening for a lucrative business in its cultivation.

The reader who may wish to try mushroom culture in a small way—which he had best do as a beginning—will find his cellar, if he dwells in the city, or any convenient outhouse, if in the country, a suitable place for a few beds. The material required is horse manure, which must be sweated by gentle and careful fermentation for a week or a fortnight, until most of the rank straw and grass is decomposed. Turn over the mass every two days, and by the end of about a fortnight it will be partially fermented, no longer offensive to smell, and in fact sweet enough to be placed in the cellar of a dwelling. An average depth of a foot or eighteen inches makes a good bed, which should be about a yard wide, with its contents well packed. The shape is immaterial. It is useless for the cultivator to prepare his own spawn, as it can be purchased very cheaply from nurserymen, at from 15 cents to 25 cents a pound. The quality, however, is important. Good spawn can be told by the minute white threads which permeate it in all directions, and these should not be too far developed. A reliable dealer will have the right kind. The spawn is first broken into bits about 1½ inches or so in cubic contents, care being taken that each piece has the white threads running through it. These fragments are planted in the manure at a depth of 3 inches, and placed about 4 inches apart. Then the bed is firmly rammed down with a spade or mallet, and about ten inches of good loam packed hard and smooth on top, the surface lastly being covered with hay or straw. Care should be taken that the cellar or outhouse selected is sufficiently sheltered, so that a constant temperature of from 55° to 60° Fah. is maintained in it. The mushrooms will appear in about six weeks, and the beds will bear for from one to three months, according to the quality of spawn, strength of manure, etc. Water only about once a fortnight and then sparingly; the temperature of the water should not be below 60° Fah.

In plucking the mushrooms pull out the stalk, as, if left, it is liable to decompose and injure succeeding crops. Instead of beds as described, the manure can be packed in boxes or tubs to within 2 or 3 inches of the surface, and loam added above. The difficulty with box culture is, however, that the heat does not remain constant, though this may be compensated for by plunging the boxes up to the rims in decomposing manure during the preliminary stages of the growth within. Mushrooms have been grown well on a warm shelf in a kitchen, and excellent crops have been obtained from beds made on shelves in a stable where the heat of the animals supplied the needed warmth. In summer it is only necessary to make a bed in the coolest and shadiest portion of the garden; this should be covered, to keep it moist and to protect it from the ravages of rats, mice, and snails, all of which will greedily eat the young fungus.

There are some valuable treatises on mushroom culture extant, from which those who contemplate extended cultivation can obtain full instructions. The cultivation, however, is so simple that very little skill is required to conduct it.

Some years ago, the Royal Horticultural Society, in England, made strenuous efforts to popularize the mushroom, and offered prizes for collections of fungi, and gave numbers of excursions and dinners in which the mushroom was substituted for meat. But little success attended these efforts, mainly on account of the difficulty found in distinguishing the genuine and safe mushroom from the dangerous and poisonous fungi, and also on account of a popular prejudice which looks upon any fungus as a mere sign of noisome decay. Of course when raised from reliable spawn, danger from eating the mushrooms is not to be apprehended; but it is unsafe to collect from pastures fungi for edible purposes unless one is familiar with the subject.

CAN WE PROTECT OUR BANK VAULTS?

Seven armed men recently entered the house of the cashier of the Northampton National Bank, at Northampton, Mass., and compelled that officer at the muzzle of the pistol to reveal the combination of his safe vault. Then they bound and gagged him and his entire family of seven persons, quietly waited until the bank's night watchman had departed, opened the vault and safe, and stole $750,000 in cash and securities. The annals of crime can show few more audacious robberies than this, nor do we know of one which has excited a wider spread feeling of insecurity or a more general distrust of all modern burglar-proof devices. Certain it is that no lock, however intricate, is safe so long as the means of opening it is in the hands of any one person; for no man, however brave, can withstand the persuasions of a night attack on his family and of a cold pistol barrel pressed against his temples in order to make him hand over his keys or divulge the information demanded. It may well be asked if seven men can plan and successfully carry out such a scheme, whether twice seven men could not perpetrate even a more gigantic robbery; and when we consider the matter in the light of the elaborate precautions taken by the thieves and their intimate knowledge, which they spend weeks in acquiring, of a marked point of attack (all detailed recently by a convict captured in a similar undertaking), it is but natural at first to doubt the safety of any bank or strong box. But on the other hand, it is reasonably certain that, if the Northampton bank people had been as vigilant as the thieves, the robbery could not have occurred; and it seems to us that, if the means which Science offers for protecting our valuables were fully used, such robberies would be impossible, or at the least be very difficult, of perpetration. Suppose, for instance, a chronometer lock had been in action on the Northampton safe. Then what would have availed the binding and gagging of the family of the unfortunate cashier, and an assault on his person, since he would have been as powerless as the thieves to enter the stronghold? At a certain time enxt day, when all the employees of the bank would be at their desks, the safe could be opened; until then, if properly made, nobody could stir its doors. Rendering it the duty of two bank officers, one as a check on the other, to assure themselves that that lock was in working order at the last thing before closing the bank for the night, would prevent any tampering with the mechanism; and should the lock be inoperative, the very circumstance would instantly suggest extra vigilance during the night and until the difficulty could be remedied.

Another safeguard is found in never trusting the means of opening the safe to a single individual, a plan frequently adopted in banking institutions in cities. There might be, for instance, three locks to a door; and the key or the combination which throws back each could be in the possession of a different officer, so that no one of the trio could enter alone. This would necessitate the robbers intimidating three persons instead of one. Or the knowledge of a combination might be kept a secret, by the president, for example, and the cashier possess only a key to be used in connection with the combination.

There is much safety to be found in properly constructed electric devices. Why, for example, has not somebody invented a thief catcher—a couple of metal knobs which must necessarily be turned in attempting to open a door? At night, lead a powerful interrupted battery current to those knobs. When the burglar grabs them they will grab him, for he cannot let go, as every one knows who has tried to release the handles of the simple magneto-electric machines from which itinerant scientists at country fairs offer to administer shocks for a penny or two each. The burglar, besides, will get so thorough a shaking that he would convert himself into an alarm, and yell loud enough to awaken any somnolent neighborhood. Electric wires might be laid from every door in the bank to convey an alarm, say to a police station or any other desired point; and if those wires were so placed that cutting them in advance could quickly be told through the breakage of the circuit, tampering with them could be found out in time and proper precautions taken.

It has been suggested that the next advance of the thieves will be a day attack on a bank, through the use of an exploding shell tossed in among the clerks, and a rush for the funds in the confusion. For this, the only remedy appears to be constant watchfulness, or the encasing of the people handling money in a separate armored room, and not dividing them by a mere wood and glass partition from the crowds which often congregate outside the tellers' windows. We have some banks in our mind whose counting rooms are very poorly suited to withstand an attack of the above kind.

We think that there is abundant ingenuity in this country to provide means of frustrating the smartest and most audacious of burglars; and that if inventors will set about it, devices much more efficacious even than those which have occurred to us can be produced. At any rate it is hardly time to suggest the abolition of banks, as does a daily contemporary of this city, and thus admit that we are outwitted by rascals, until we have seen what the inventors can do, and certainly not before we have fairly tried the safeguards with which we are already provided.

REMARKABLE PUMPING ENGINES.

We publish in this week's SCIENTIFIC AMERICAN SUPPLEMENT (No. 9) two pages of engravings illustrative of the remarkable steam pumping machinery, lately completed at Hammersmith, England, by Messrs. Gwynne, for the drainage of the Ferrara Marshes, Northern Italy.

The tract to be drained covers an area of 200 miles. The machinery we allude to is calculated to discharge 456,000 gallons of water per minute, or 656,640,000 gallons per day; being about six times the capacity of the Croton Aqueduct of this city, which is able to deliver 110,000,000 of gallons per day. The water delivered by these remarkable pumps forms a stream 103 feet wide and 4 feet deep, having a speed of two miles an hour; one day's delivery would fill a reservoir one mile square to a depth of 3 feet 9 inches. In view of the completion and successful operation of gigantic and economical machinery like this, the drainage of the Zuyder Zee, in Holland, which is about to be commenced, is rendered a comparatively easy task. The Zuyder Zee area to be drained is 759 square miles. Splendid models of the abovementioned machinery are to be exhibited in the British department of the Centennial Exhibition.

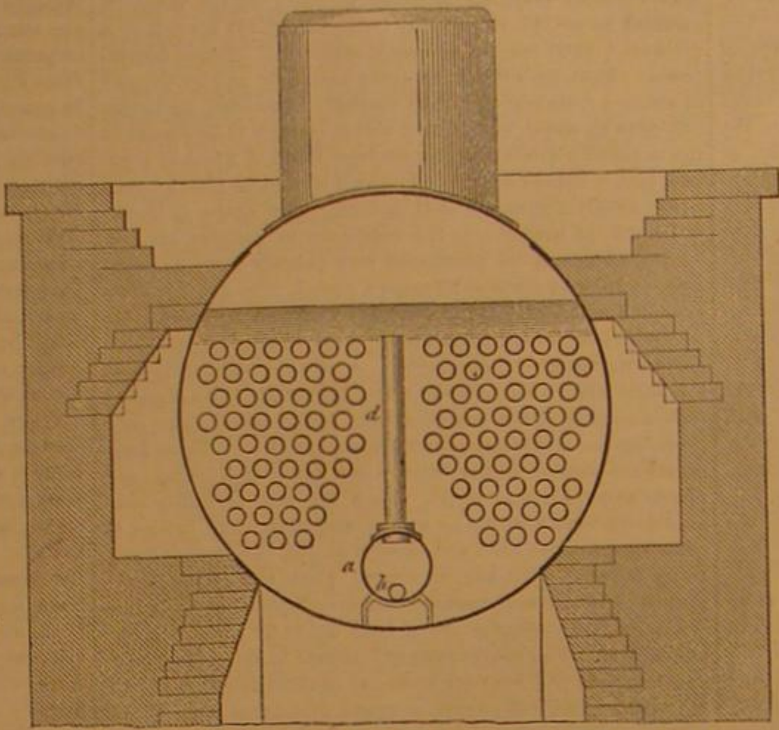
Improved Lantern Galvanometer.

In the arrangement recommended by Professor Nipher, an astatic system of needles is used, supported by silk fiber. The distance between these is four inches, and the system is placed over the lens of a vertical lantern. The image of the lower needle is thrown upon the screen. The upper one is out of focus and is invisible. The needles are deflected by two coils situated on each side of the upper needle, and out of the field of view. The distance between the coils is varied to any desired extent to adapt the instrument to the different currents. The connections are such that the instrument can be instantly used in measuring electrical resistances. The resistance can be diminished in working with the thermo-currents, or increased with ordinary galvanic currents.

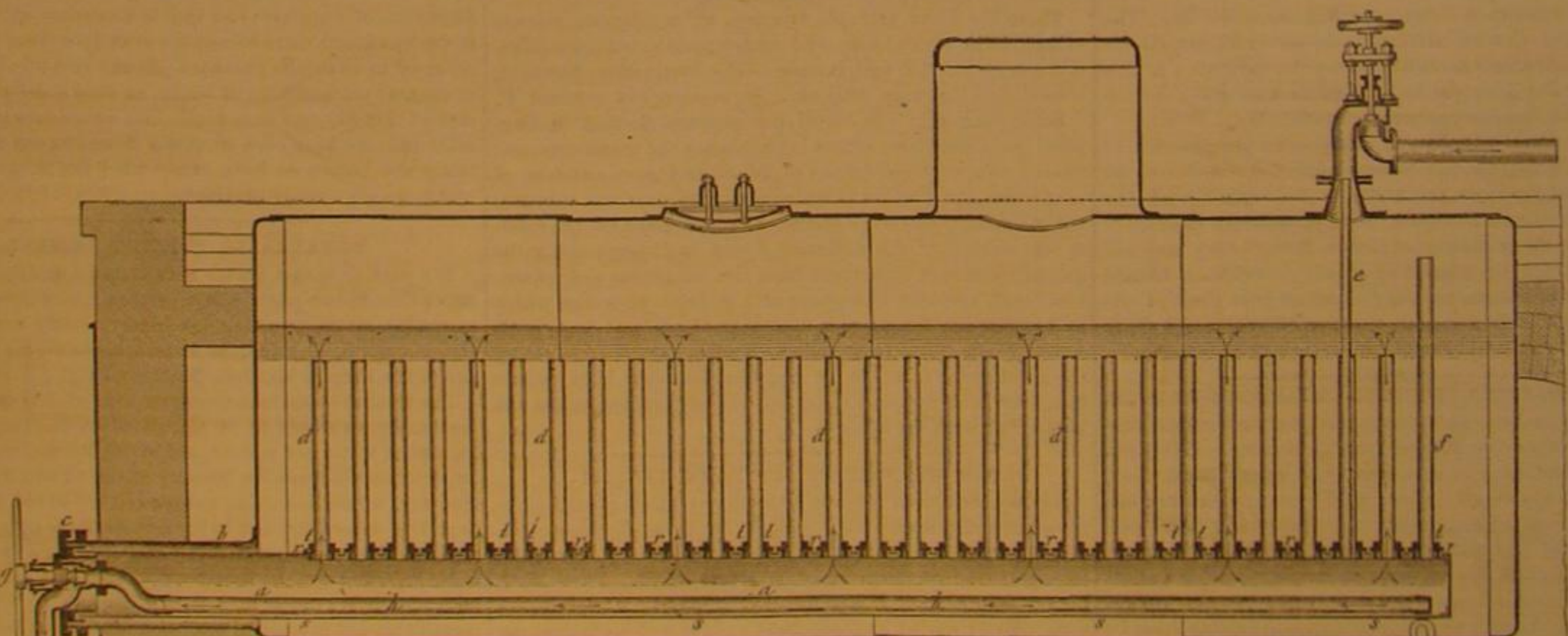
NEW AUTOMATIC FEED WATER PURIFIER.

Mr. H. Paucksh, in the *Zeitschrift des Vereines Deutscher Ingenieure*, describes a new feed water purifier for steam boilers, sectional views of which are presented herewith. It consists of a cylinder, *a*, Fig. 1, which extends nearly the whole length of the boiler, and which is secured in the cover, *c*, of the passage, *b*. Arranged along the top of the cylinder is a series of tubes, *d*, vertically disposed and of such a hight as to have their upper extremities level with the top row of boiler tubes. The last tube, *f*, Fig. 2, is carried somewhat higher, and differs from the others in having an open orifice, the latter having their apertures partially closed by a perforated cover. All the tubes, *d*, are secured in the cylinder by cast iron riveted rollers, *r*, and washers of wrought iron, *t*. This arrangement admits of the easy insertion of the cylinder through the passage, *b*, while the tubes may be attached or removed by entering the boiler after the cylinder is in place.

The feed water passes in by the pipe, *e*, and rises in the tubes, *d*, after filling the cylinder, escaping at the orifices of the tubes, and gradually fills the boiler. During this time it becomes heated, and the impurities settle at the bottom of the cylinder. To remove the deposit, a pipe, *h*, the lower part of which is channeled, and which has a valve, *g*, on its forward end, is placed near the lower part of the cylinder. On opening the valve, *g*, the pressure of steam in the generator forces out the contents of the tube, together with a quantity of water, which last is, however, compensated for by the supply which enters from the vertical tubes, *d*. The last tube, *f*, through its having an open upper orifice for the admission of steam, serves to augment the force of the current which, on the evacuation of the deposit, is produced in the rear part of the apparatus, and to render the same uniform through the tube, *h*. At the same time the tube, *f*, acts as a kind of safety valve in case of obstructions choking the other tubes.



PAUCKSH'S FEED WATER PURIFIER.—Fig. 1.



PAUCKSH'S FEED WATER PURIFIER.—Fig. 2.

New Industries Wanted.

We want in the Mississippi valley the initial step towards the following new industries of her people:

1. Linen manufacture, to save the flax now wasted, also to save the $25,000,000 annually sent abroad for linen goods.
2. The growth of sugar beets and their manufacture into sugar, to give employment to our people at home, and save the $100,000,000 in gold now paid to other nations for sugar.
3. The manufacture of earthen, stone, and china ware, to save the $10,000,000 annually paid to foreign nations.
4. Leather manufacture, gloves, etc., to save the $10,000,000 of gold sent abroad.
5. The manufacture of silk, to save $25,000,000 in gold annually sent to France.
6. The manufacture of watches, watch movements, and materials, to save the $3,000,000 in gold annually paid for these things.
7. The manufacture of tin plate to save the $13,000,000 in gold annually paid out for them.
8. We want an increase in the manufacture of cotton goods to help save the $30,000,000 in gold annually paid to support the people of other nations.
9. An increase in the manufacture of glass and glass ware, to save the $6,000,000 annually sent abroad.
10. We want an increase in the manufacture of woolen goods to give employment to our people and save the $50,000,000 in gold annually paid to support the people of other nations.
11. We want an increase in smaller manufactures of all kinds to keep the people employed and rich, and hungry for the farmer's products.
12. We want ten people where there is but one all over this fertile valley to eat our produce and save the millions annually expended in shipping it away.—*Engineering News*.

Cosina.

This is the name given to a curious new dye prepared by Dr. Caro, of Stuttgart, Germany. Whenphthalic acid, obtained by the oxidation of naphthalin and resorcin, which is prepared by heating assafœtida with alkalies, are heated together, a fluorescent substance is produced. From the latter, treated with reducing agents, fluorescin, a colorless base is derived. The new dye stuff is produced from fluorescin by treatment with bromine in combination with potash, and its solutions in alcohol are of a delicate rose color in transmitted, and a pure yellow in reflected, light. The shades produced on wool, also on silk, resemble those of cochineal. On silk, the dye shows red or yellow according as the fabric is viewed. The material is now very expensive, being worth $100 a lb.

American Potatoes Abroad.

The *Journal of the Royal Agricultural Society*, of late issue, contains a valuable article, by Mr. H. W. Bates, F.S.L., on the Colorado potato beetle. Mr. Bates thinks that the introduction of the pest into England is not at all probable, and doubtless the opinions which he advances will do much toward removing the uneasiness felt regarding, as well the restrictions laid upon the importation of, American potatoes abroad. "American potatoes," he says, "are imported into Britain only for seed purposes, and in remarkably clean condition. Newly arrived casks which I saw opened contained not a particle of refuse, and no pellet of soil large enough to contain a hybernating beetle." If, however, beetles should fly on board ship, in the harbor of New York, and find a snug lodging for the voyage, they might fly off at Liverpool; but even in this ultra-hypothetical case, Mr. Bates thinks "there is little probability of their propagating and spreading in this country."

THE surest remedy for chapped hands is to rinse them well after washing with soap, and dry them thoroughly by applying Indian meal or rice powder.

English Grease Butter.

The butter and cheese dealers of this city, who opposed oleomargarin in the markets on the alleged ground of its being used as an adulterant for genuine butter, instead of its being sold on its own merits, will seem to most people ultra fastidious beside their English and Scotch brethren, who have permitted the existence of such an establishment as the *Glasgow News* recently has unearthed. That journal discovered a trade circular issued by a firm established in Leith and Glasgow, offering to reclaim old butter, however foul, and to return the same increased in weight, at a cost of $1.87 per cwt., in casks. Reporters, personating customers, prepared for treatment a sample of the following delectable mixture: A Coleraine butt of grease butter, sold for lubricating purposes, was purchased, and there was incorporated with it a small quantity of Russian tallow, some of which had passed through the printing office machinery, and had absorbed particles of blacklead and mineral oxides from contact with the bearings of the shafting. A common tallow candle, from which the wick had been removed, was also added. The compound and the tallow candle were carefully melted into the grease butter; and notwithstanding the offensive character of these additions, the butter was so decomposed as completely to disguise them. Thus prepared, the firkin was sent to the works, with a request that it be turned into "lumps of a bright yellow color, for sale in the English market, and with a stubble-grass smell." The firm characterized the sample as very bad, but promised to do their best with it. In the course of a few days the butter was returned re-converted, its weight on return being 51½ lbs., against 47½ lbs. when sent for treatment. Were it not for some mineral particles discovered on strict examination, it would hardly have been possible to have identified the sample, so remarkable was the change in the whole composition. These statements are verified by the city analyst, who described the original butter as "in the last stage of rottenness, having a disgusting odor, covered with green mold, and maggotty."

It was found that the establishment was doing a large business and producing 3,920 lbs. daily, which was sold over the entire kingdom. What the treatment consisted in is not explained. Oleomargarin at least was clean, and its ingredients, so far as our examination extended, were pure.

A New Crystallized Hydrate of Hydrochloric Acid.

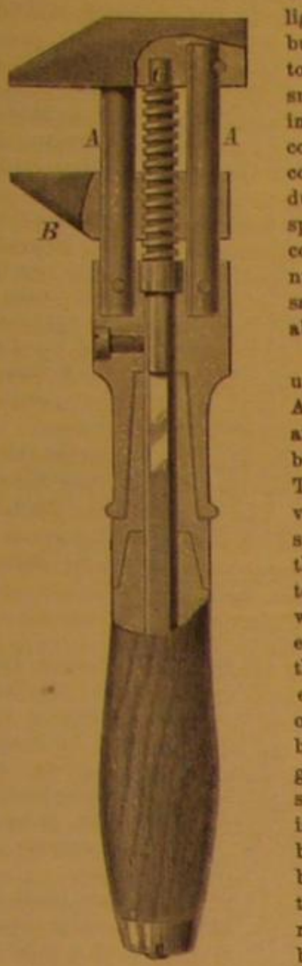
There is an abundant crystallization produced in hydrochloric acid at —13° Fah., when a current of nearly dry hydrochloric acid gas is passed through it. The authors deduce a new way of making a freezing mixture by mixing 2 parts of snow with 1 part commercial hydrochloric acid. The temperature obtained will be —25·6° Fah. By previously cooling the acid to —5° or —4° Fah., a temperature of —31° Fah. will be reached. This is difficult to maintain, but —13° or —15° Fah. may be steadily kept by successive additions of snow and slightly cooled acid.—*MM. J. Pierre and E. Puchot.*

THE black dogwood or the berry-bearing alder make the best charcoal, willow is next, and common alder third in rank. Small wood of about ten years growth is in all cases to be preferred for charcoal for making gunpowder. Alder and willow of this age will be probably 4 or 5 inches in diameter, dogwood about 1 inch.

THE kangaroo has been introduced on several large estates in France, and is now hunted in that country as game. It readily adapts itself to the climate.

PORT'S IMPROVED WRENCH.

We illustrate herewith a new and simple form of wrench, easily and swiftly adjustable, and so constructed as to insure strength and at the same time lightness. It is made of steel; but it is claimed that, owing to its construction and the small amount of metal therein employed, it is no more costly than an iron wrench of common form. It can be produced, we are informed, by special machinery, so that the corresponding parts of any number of wrenches of the same size may be interchangeable.



The standing jaw is secured upon two cylindrical columns, A, which are rigidly held, and which also serve as guide bars for the moving jaw, B. The latter is caused to traverse by the screw, C; said screw passes through a female thread in the jaw, and is rotated by turning the handle in which its straight shank is embedded, and fastened by the nut shown at the lower extremity. The arrangement of the two columns or guide bars is one well calculated to give the tool strength and stiffness, since, when strain is applied, neither bar can bend without the other also bending; and this is a condition which the construction renders practically impossible. The screw acts as an additional bar, re-inforcing the others.

The device as a whole, as the engraving plainly shows, is ingeniously simple, and it appears to be abundantly able to withstand severe strain.

Patented November 30, 1875, by Mr. Henry Port, of Staten Island, N. Y. For further information relative to sale of rights or of wrenches, address Mr. John A. Amrein, Sinking Spring, Pa.

IMPROVED LATHING MACHINE.

Mr. Charles B. Trimble, of New York city, has recently patented the apparatus illustrated herewith, the object of which is to facilitate the operation of lathing buildings for

Fig. 1

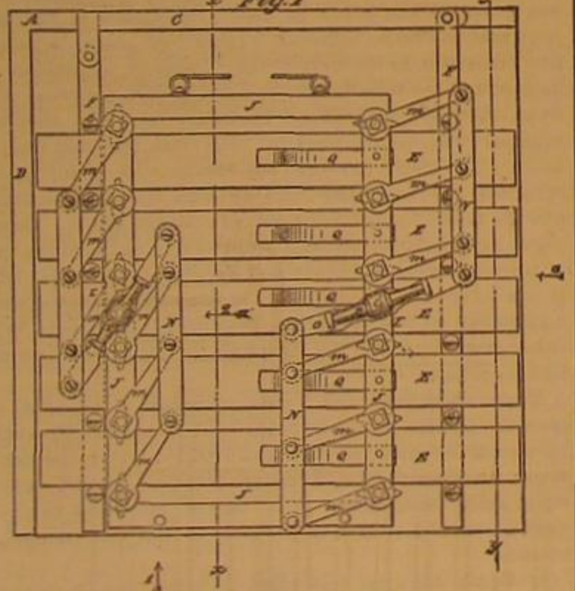


Fig. 2

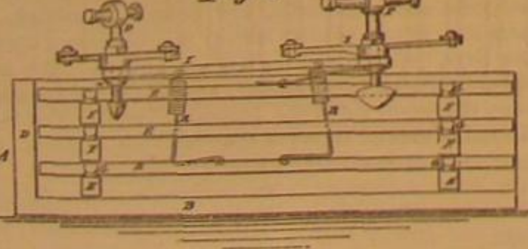
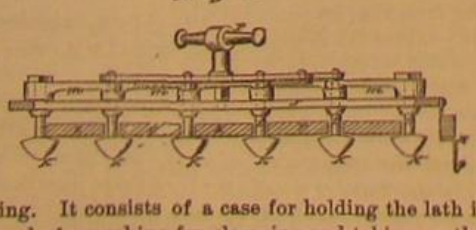


Fig. 3



plastering. It consists of a case for holding the lath in position, and of a machine for clamping and taking up the lath and placing them on the wall or ceiling.

Fig. 1 is a top view of the clamp laid upon the first tier of lath in the case, the left hand clamp being turned to clamp one end of the lath, the other clamp being ready to be turned. Fig. 2 is an edge view of the case and clamp, looking in the direction indicated by arrow 1. Fig. 3 is a vertical section of Fig. 1, looking as indicated by arrow 2, from the line, $x\ x$. A is the case, composed of bottom, B, and two sides, C D, of square or rectangular form, and of sufficient hight to contain one or more tiers of lath, arranged as shown in the engraving. E is the lath, which is about 4 feet in length, about 1½ inches wide, and ⅜ inch in thickness. These pieces are arranged in the case in the position they are to occupy when nailed on the wall or ceiling. The tiers of lath rest on hinged bars, F, and are separated by the wedge shaped pins, G. On the bottom of the case are two stationary bars, H H, over which the other bars rest, as seen in Fig. 2. The lath, being thus placed in the case, are taken up by the clamps, and laid upon the joist or studs, in the same position they occupied when in the case. There are two sets of gripes, I I, which are arranged to support each of the ends of the lath. These clamps are attached to an oblong frame, J, and consist of a series of buttons, K, Fig. 3, having shanks, L, which pass up through the frame, and receive each an arm, m. These arms are connected together by means of the flat bars, N. The bars are attached to the central bars, O, to the middle of which are attached the handles, P, by means of which the central bars, O, and the arms are turned. These bars, O, and the handles, P, are placed in the middle of the opposite sides of the frame, J, so that the frame, J (with clamps), will balance when lifted. One half of the arms, m, of each clamp extends outside and half inside of the frame, J, so that when the handles are turned the arms are thrown in opposite directions, but so as to turn all the buttons, k, in one direction, to either take up or release the laths. As seen in Fig. 3, a tier of lath is supported by the buttons. When the buttons are turned so that their sides are parallel with the lath, the latter are released. Q are springs attached to one or both sides of the frame, J, the ends of which bear upon the separate pieces of lath to hold them in place. R R are spring hooks to be used in lathing overhead, which engage with the firrings on the ceiling for supporting the frame, while the other end is held up by the bottom engaging with the lath already on. "By means of this apparatus," says the inventor, "labor and time are saved, as the lath can be laid very expeditiously, and the spaces between them are made of uniform width."

IMPROVED SUBMERGED CURRENT WHEEL.

The water motor illustrated in the annexed engraving is intended to be entirely submerged, to be operated by the action of the current or tide

Fig. 1

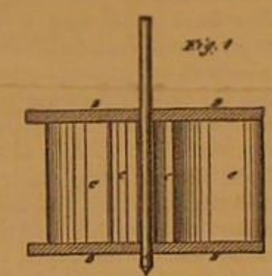


Fig. 2

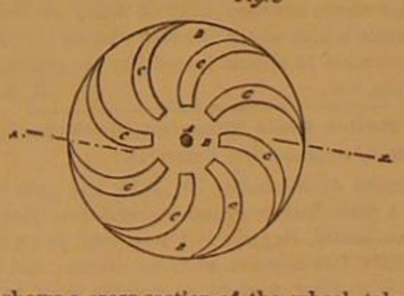


Fig. 1 shows a cross section of the wheel, taken through the line, $x\ x$, in Fig. 2. Fig. 2 is a top view, with the cover removed. A represents the shaft to which the wheel is attached, the lower end of which is designed to revolve in a step in a simple frame secured in the bed of the stream. The upper end of the shaft is designed to extend above high water mark, and with it is connected the gearing to give motion to the machinery to be driven. To the shaft, A, at suitable distance apart, are secured two disks, B, between which the buckets, C, are placed, and to which the upper and lower edges of said buckets are attached. The buckets are vertical, are thicker at their inner ends, taper to an edge at their outer ends, and are curved, as shown in Fig. 2. The inner ends of the buckets, C, do not extend quite to the center of the shaft, so as to leave a clear space around the shaft, A. With this construction, the water will enter at one side of the wheel, and escape at the other side, giving it an impulse both times, and will rotate the said wheel in the same direction, in whatever direction it may be flowing.

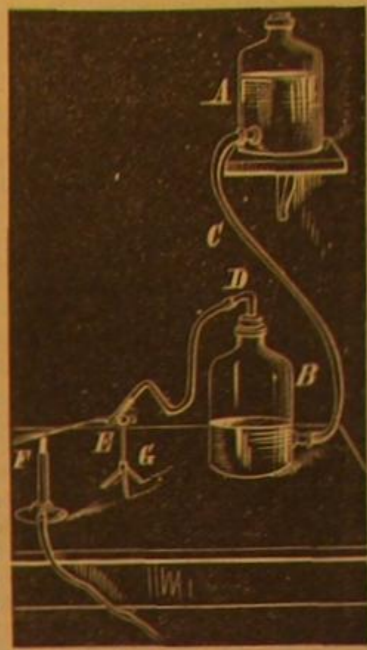
Patented November 23, 1875. For further particulars, as to sale of patent, etc., address Mr. John J. Hill, Hayden's Ferry, Arizona Territory

The Scientific American in the Pulpit.

An esteemed correspondent, writing from St. Louis, Mo., states that, in one of the Catholic churches there, during an interesting discourse upon the best methods of avoiding evil influences and promoting practical goodness, the speaker took occasion to caution his hearers against the reading of trashy papers. "If," said the preacher, "you want a first class paper, get the SCIENTIFIC AMERICAN. The proprietors of such journals are public benefactors." To which, we have no doubt, a quarter of a million of our readers will heartily say: Amen.

A SIMPLE FORM OF BLOWPIPE.

The simple method of obtaining a continuous self-acting blast for blowpipe work, shown in our illustration, was devised by J. Landauer, of Braunschweig, Germany, and described in a late number of the *Berichte der Deutschen Gesellschaft zu Berlin*. It consists of two spacious bottles, A and B, connected by an India rubber tube, C. One, A, is filled with water and placed on a shelf above the working table; the other, B, is closed by a perforated rubber stopper, from which a tube, D, leads to the blowpipe, E, supported on a standard, G. As the water flows from A to B, the air in B is compressed, and a jet of air is driven across the flame of a Bunsen burner, F.



With bottles that hold 7½ pints each, a constant current of air of 0·016 inch diameter is produced, which lasts for 10 minutes. At the end of this time it is only necessary to reverse the bottles in order to put the blast again in operation. With a convenient fall of 35 inches, a reducing flame may be obtained 3·15 to 3·50 inches long, and an oxidizing flame 2·7 to 3·15 inches long.

If bottles with holes at the bottom are not at hand, ordinary bottles can be employed, connected by tubes running to the bottom, like siphons. In this case the air must be sucked out of the tube, C, before beginning to work. The flow of water, as well as the current of air, may be regulated by pinch cocks with screws, or even by a common spring clothes pin. The advantage of this blast is that all the materials are at hand in every laboratory.

IMPROVED BARBERS' APPARATUS.

We illustrate herewith two recently patented inventions for facilitating barbers' work, the first of which is an improved combination of shears and comb. The device is the invention of Mr. Samuel Nickerson, of Gallatin, Tenn., and consists of a comb secured to the side of one of the blades; and a guard or shield is placed between the blade and comb, serving to govern the length at which the hair is cut, and to present the same properly to the blades.

Fig. 1 represents a perspective view of the shears, and Fig. 2 a side view of the same A is an ordinary pair of

Fig. 1.

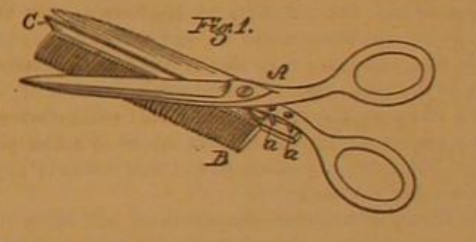
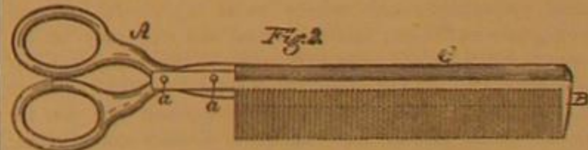


Fig. 2.



NICKERSON'S BARBERS' SHEARS.

shears, and B is a straight hair comb, arranged outside of and parallel with one of the shear blades, and secured thereto at the inner end by two screw studs, a; and C is a guard

Fig. 1

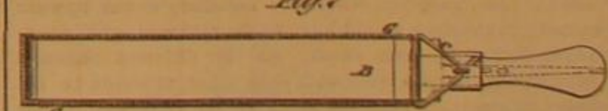


Fig. 2

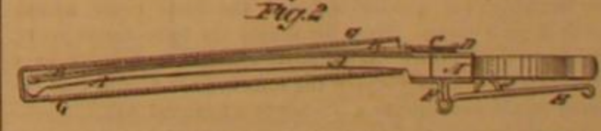


Fig. 3

MAXSON'S RAZOR STROP.

plate, extending from the back of the comb, over which it is clasped, inward to the edge of the shear blade, as represented in Fig. 2. The parts are arranged to hold the comb and the blade parallel with each other, while the screw studs are so arranged that by turning them, the distance between the blade and comb may be increased or diminished at will. The guard plate, having its edge curled over in the manner shown, is simply slid endwise upon the comb, so that it may be readily removed when desired. In use, the hair is caught upon the comb, and the shears operated in the ordinary manner, the comb serving to present the hair in proper and even shape to the blades, and also, when rested upon the head, to govern the length at which the hair is cut, rendering the same uniform and smooth.

The second illustration shows an improved razor strop, the invention of Mr. John Maxson, of Scott, N. Y. Fig. 1 is a front view of the strop, closed, the case being again shown in section. Fig. 3 is an edge view of the same arranged as a convex hone. The object is to furnish a strop which may be used as a haul strop, a straight hone, a flexible convex hone, and a spring strop.

A represents the stock of the strop, which is faced with leather. To the forward end is attached the end of a loose strop, B, of the same length and breadth as the face of the hone, A, to the free end of which is attached a ring, C, to hook upon a hook, D, attached to the forward side of the handle, and also to hook upon the hooks, *e*, formed upon the lever, E. The lever, E, is pivoted to a stud or bracket, F, attached to the handle, so as to leave room for the hooks, *e*, when the lever, E, is turned back against the handle, and to allow the lever to turn so that the tension of the strap, B, will lock it in place, the ring, C, being made large enough to pass over the rear end of the lever, E, and over the bracket, F, Fig. 3. When the strap is to be put into the case, G, the strap, B, is turned forward upon the face of the hone, A, and the ring, C, is hooked upon the hook, D, which prevents the face of the hone from being rubbed by the case, G. This is also the adjustment when the strap is to be used as a haul strop. By detaching the ring, C, from the hook, D, and throwing the strap, B, back, the instrument is a straight hone. By swinging the lever, E, forward, passing it through the ring, C, passing the said ring into the hooks, *e*, and drawing the lever, E, back, the stock, A, is bent to form a flexible convex hone, to enter the hollow of the blade and keep the edge thin; and at the same time the strap, B, being brought under tension, becomes a spring strop for setting the edge.

Correspondence.

A Second Channel for the Erie Canal.

To the Editor of the Scientific American:

I have a suggestion to make for increasing the capacity of the Erie Canal; and although it involves a large outlay, I believe the State would be justified in adopting it, at least for a part of the distance, say from Buffalo to Rochester. I propose to separate the downward bound from the upward bound boats, thereby having a distinct and separate channel for each; to effect this, I would have the work commence at the west end, at Buffalo, and dig another canal, alongside of the present one, from Buffalo to Rochester. Let the new canal be of the same width as, and 3 feet deeper than, the present one, and make it so that it will have a descent of 7 inches to the mile; this will establish a current of water of about 3 miles per hour; and then a boat will go, where speed is not a matter of importance, at about 3 miles per hour without requiring any steam power, and without any swell or washing of the banks.

This theory of a double channel canal will apply to other canals, or parts of canals, where water is plentiful and the down grade sufficient; and the speed and size may be increased or diminished so as to conform to the topography of the country and the requirements of commerce, the engineers being guided by experience. I have suggested this size for the Erie Canal, because one channel is already constructed; and if the authorities will dig the other of the same width and 3 feet deeper, it will, I think, be of the proper proportion. It should, however, accommodate such a brig as those which sail the Lakes; and the brig could draw 8 feet of water in the down grade channel and 6 feet in the upward. Some changes, however, would be necessary in the upward channel; the bridges would have to be removed, and drawbridges erected in their stead. As the different channels would seldom be on a level with each other, it would be necessary to construct partition locks at all important towns along the way, so as to lock from one channel to the other.

I think this improvement might be constructed from Buffalo to Rochester for $35,000,000, and the State could accomplish it in 5 years. Then, by saving the tolls for 20 years, the State might construct a similar distance further east at a similar cost, always keeping the tolls at such figures that the canal would not become a burden in a financial way.

I claim for this theory that, in the eastward or downward direction, it would double the speed of the boats and quadruple the capacity of the present canal; and that it would be much more convenient for boatmen, for it would enable them to transport freight for one half the price which they now do, and pay the same tolls. I have based my estimates on a knowledge of the topography of the country gained by 20 year's experience; and would be pleased to have the opinions of some of the local engineers.

Sioux Rapids, Iowa. W. T. CROZIER.

A Cheap Refrigerator Wanted.

To the Editor of the Scientific American:

As ice water is a necessity, I suggest that some one of our manufacturers of paper pails should put into the market an ice cooler, made of paper with a jar of glazed pottery inside, with sawdust between the two vessels. Such a utensil would be within the reach of all as to price, and paper being a good non-conductor of heat, it would be far superior to the metal of which most coolers are now made. I made one last summer from a large paper box, in the manner above described. In the next office to mine, with similar temperature, there was a cooler made with an outside of tin, zinc-lined, and filled in with charcoal. Each morning a similar quantity of ice was put into each. The result was that, at about 4 P. M. every day, the ice in the metal and charcoal cooler had disappeared; and in the paper and sawdust one, there was ice left on the following morning.

If any manufacturer of paper pails avails himself of this suggestion, I shall be paid for making it, and will have an opportunity of replacing the homemade one I now have with one more ornamental.

Cottonwood Springs, Neb. C. H. ROBERTS.

A Solar Phenomenon.

To the Editor of the Scientific American:

I inclose a diagram of a solar phenomenon which appeared on January 31, at 10:30 A. M. The day was warm and spring-like. At night the air turned cold, and a light snow fell. The intersecting circles over the sun formed an Indian bow,

and showed the prismatic colors very brightly. The halos extending from the sun dogs were long and straight, their outer ends being higher above the horizon, as represented in the engraving. C. O. HOWARD.

Waukon, Iowa.

Bored or Driven Wells.

To the Editor of the Scientific American:

Some time since I noticed in your journal the question: "Are not bored wells a failure, on account of the small cistern they have for holding water?" The following are a few facts on the system as used in California.

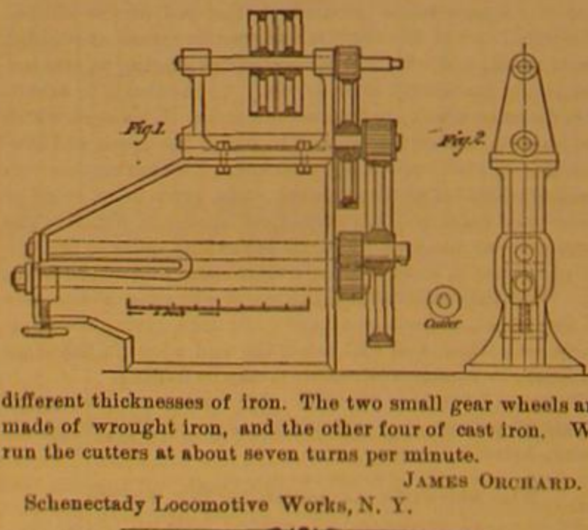
We have been in the business of well boring here for 18 years, and in that time have never seen a well properly bored, which failed to give an inexhaustible supply of water. We have on our place a well of 6 inches diameter and 35 feet depth, from which the largest hand fire engine in the city, running at its utmost speed, had a plentiful supply. At some shops in this city, there are two wells of 13 inches diameter and 75 feet depth, situated 6 feet apart, in which are two six inches by 4 feet pumps, working almost constantly at 24 strokes per minute. At a woolen mill there are two more, of similar diameter and 35 feet depth, in which are two pumps of the same size as the others. In the Sacramento Valley alone, are thousands of wells of from 3 to 10 feet deep, from which water is being drawn for irrigation and other purposes in almost incredible quantities.

Sacramento, Cal. R. A. ROSE.

Boiler Plate Shearing Machine.

To the Editor of the Scientific American:

In your issue of December 18, 1875, you gave us an engraving of a plate-shearing machine with revolving cutters, made at Manchester, England. I now send you a sketch of one I had made last summer at these works; and it is now running daily, cutting straight or circular work, in iron up to one quarter of an inch thick, and giving good satisfaction. The main shafts are made of steel, and the lower one has a set screw below the box to raise or lower the cutter for



different thicknesses of iron. The two small gear wheels are made of wrought iron, and the other four of cast iron. We run the cutters at about seven turns per minute.

JAMES ORCHARD.

Schenectady Locomotive Works, N. Y.

Destructive Boiler Explosion.

To the Editor of the Scientific American:

On January 25, 1876, an upright boiler exploded at Barnet, Vt. It was in the cellar of a shoe peg factory, and the concussion shattered the building in a fearful manner, the boiler (8 feet long by 3¼ feet diameter, with seventy-five 1¼ inch flues) going up through two stories and out through the end of the building into the road, 90 feet in all. The power of the explosion was so great as to throw a dryer in the second story out of its place and drive it, through a double boarded floor, up against the rafters, breaking in its course a cast iron shaft 5 inches diameter, and also breaking four sticks of timber 8x9 inches, and taking two floors clean out; and much other damage was done.

At the time of the explosion there were 16 persons in the building, 8 of them being women, within twenty feet of where the boiler went up; but, happily, no one was killed or hurt. The boiler was run, by a boy of no experience, in a blundering way. Steam was made only for heating and drying.

The explosion was caused, I think, in this way: Around the foot of the boiler there was a space of two inches between the outside plate and the firebox, which was two feet high. The boiler had not been blown off for two weeks or more, and the water that supplied it came from a very muddy brook, and must have filled the bottom full of fine dirt; and this dirt, caking on the fire sheets, caused the firebox to get red hot and bulge out, and then the water above, coming in contact with the red hot iron, caused the explosion.

If any one who has boilers or machinery desires the safety of himself, his work people, and his property, he should invest $3.20 in the SCIENTIFIC AMERICAN, and he would do away with much blundering and many disasters.

Barnet, Vt. GEO. H. KIDNEY.

[For the Scientific American.]

A NEW MEDICAMENT.

Boldo is the name given in Chili to a small aromatic tree indigenous to that country. It was first described by Molina, in 1782, under the name of *peumus boldus*. Jussieu, in his "Naturel System of Botany," places the boldo in the family of the *monimiaceæ*, under the name of *boldea fragrans*. M. Baillon, in the "Histoire des Plantes," now in publication in numbers in Paris, restores Molina's designation, *peumus boldus*. The sub-order to which the tree belongs consists of only eight genera, chiefly natives of South America.

The boldo, always green, grows alone and is not found in forests. Its leaves are in pairs, opposite and unfurnished with stipula. In drying, the leaves become of a reddish brown. The flowers are disposed in upright clusters (cymes), the stem of one cluster being the end of the branch, the others being axillary, or springing from the junction of the leaves. The flowers are of a yellowish tint on a white ground, and are in marked contrast with the brilliant green of the foliage. The bark of the tree, thin, and wrinkled longitudinally, gives out a very pronounced aromatic perfume. The flowers are diœcious, that is to say, unisexed, with the two sexes growing on different trees. The flower has a calyx proper or perianth; and in the male flower the receptacle has numerous stamens. The female flower has from three to five free carpels, each with one cavity, the ovary containing a single ovule or seed germ. The fruit is about the size of the berry of the hawthorn, with a very hard stone.

An interest above its botanical history and classification was given to the boldo in 1869. Specimens of the plant were sent to France, attention having been called to its curative properties, as not unfrequently happens, by accident. A flock of a sheep were tainted and dying with a disease of the liver. The hedge about the enclosure in which they were confined was one day prepared with fresh branches from the boldo. The sheep devoured the leaves with avidity. The repairs of the fence were kept up with the same material, and the flock of sheep recovered and became sound. On such vague reports, no serious data could be founded as to the value of the remedy, or the mode and circumstances under which it can be applied. Careful and systematic experiments were undertaken by MM. Dujardin, Beaumetz, and Claude Verne. Other practitioners in the hospitals of Paris have pursued like inquiries.

Messrs. Beaumetz and Verne submitted to chemical analysis the specimens of the plant sent to them. Treated in succession by ether, alcohol, and distilled water, the results were: An essential oil, a bitter principle named boldina, citric acid, lime, sugar, gum, tannin, and some thick and dark aromatic matter, due probably to the oxidation of the essence.

In South America, this plant is often used in infusions, the properties of which are (analogous to those of tea and coffee) tonic and diaphoretic, and promote digestion. It appears also to be a popular remedy in syphilis and diseases of the liver. All parts of the tree are utilized. The green leaves are used to flavor sauces; and dried and reduced to powder, the leaves serve the purpose of snuff. The wood, which burns slowly, makes a charcoal high in favor with the smiths, and the bark is used for tanning skins. The fruit is eaten, the stones of the berries are strung for necklaces and bracelets, and from the kernels a fixed oil is extracted.

Many pharmaceutical preparations have been experimentally tried by M. Verne. These are two extracts (one alcoholic, the other aqueous), an essential oil, a tincture (little differing from that prepared in Chili), a wine which possesses in a high degree the aromatic properties of the plant, and a sirup, which would seem to be, on account of its agreeable taste, easy of administration. The essential oil has so strong an odor and so sharp a taste that it is found necessary to inclose it in pills or capsules. Each contains eleven centigrammes (a little more than two grains) of the oil. Preparations in the form of a tincture or elixir make a pleasant change for the invalid in his habitual disgust for medicines. Experiments upon Guinea pigs and dogs have been made in the laboratory of M. Vulpian; and the results have been drowsiness and a lowering of the temperature, without serious effects upon the organism

M. Beaumetz has prescribed preparations of the boldo as a diffusible tonic in chlorosis, anemia, and debility of various organs, and as a restorative to patients convalescent from typhoid fever. The results obtained have been very marked. In such cases, the appetite has been stimulated and the digestion improved; and in instances where quinine could not be endured, the boldo has satisfactorily answered. But the new remedy must be administered with caution, since, in over doses, it provokes vomiting. While the experiments, made so far, are not absolutely conclusive, the boldo may be received as a bitter aromatic tonic and a remedy, which, hitherto unknown to medicine, may claim, if its results continue favorable, an honorable place in the pharmacopœia.

PRACTICAL MECHANISM.

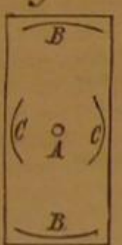
BY JOSHUA ROSE.

NUMBER XLII.

LINING OUT CONNECTING RODS.

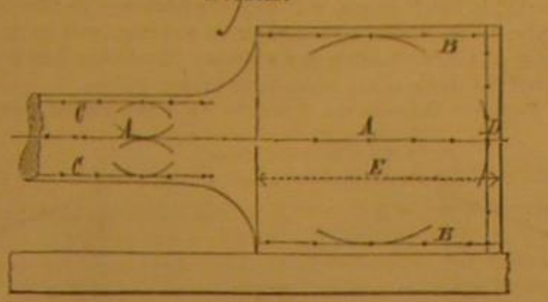
Connecting rods, so large in size as to be cumbrous to handle, are generally made by forging the ends to which the strap is attached by themselves, and afterwards welding them to the body of the rod: the advantage being that the machine work done to the rod ends can, in that case, be done in small machines and at a higher rate of cutting speed than would be possible if, the rod being solid, its whole body had to be chucked in order to operate on the ends only. If any finishing is required to the body of the rod, it is in such case done after the rod ends are welded to it and made true to the already finished block end of the rod. If, however, the rod is forged solid, the whole of the marking-off should be gaged to suit the body of the rod. For instance: If the stem of the rod is round, the marking-off of the ends should be performed from a center marked off true with the round stem and on the end face of the rod. The first operation should in this case be, after marking off the said center, to put the rod in the lathe and face off the block end faces, thus giving us a face, at each end of the rod, true with the stem of the rod, and therefore useful not only to receive the marking off lines but also as a face whereby to true the other faces on the block or stub end. If the ends are forged separately from the body of the rod, it is better to face off one of the side faces, and to mark off on that side face. To mark off a rod end that is forged solid with the stem of the rod, we proceed as shown in Fig. 210, A representing the center, true with the body of the rod; B B shows the diameter of the rod end struck with the compasses from the center, A, and C C, the thickness of the rod struck in like manner. If there should not be sufficient metal on the block end to permit the marking-off to be performed from the center, A, when true with the body of the rod, that center must be moved sufficiently to allow the rod end to be cleaned up; this is, however, to be avoided if possible, for the following reasons: If the body of the rod runs much out of true, the turning of it in the lathe will be a slow process, because such rods are liable, from their length, to spring in consequence of the pressure of the cut. Hence it is not practicable to take heavy cuts along it; and if in consequence of the body of the rod running much out of true, it cannot be cleaned up at one cut, the tool will scrape, during the first cut, against the scale, necessitating that the cutting speed of the tool be much less than it otherwise need be.

Fig. 210.

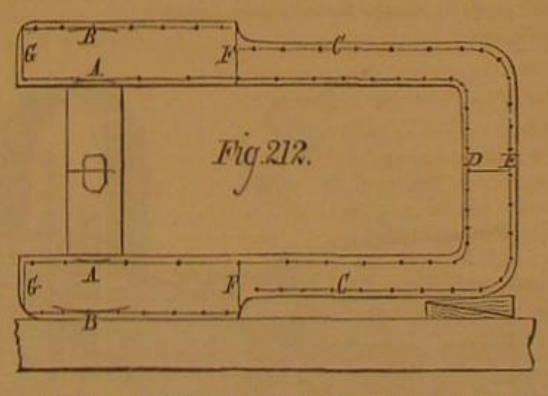


After the segment of circles, B B and C C, in Fig. 210, are struck, which may be done before setting the rod on the marking-off table, the rod should be set on the marking-off table with one of the broad faces downwards, and with the scribing block needle point placed level with the mark, C, on the upper face; and the rod should be tried along that face to ascertain if there is sufficient metal to clean it up all across. The scribing block should then be carried to the other end of the rod, and tried with the upper mark, C; and that being found correct, the scriber point should be set to the lower mark, C, at each end of the rod; and thus the two lines across the rod end, representing the thickness thereof, may be drawn by the scribing block at each end of the rod. The lines representing the breadth of the block end of the rod may then be drawn by simply placing a square on the surface table, with the edge of the square placed in each case level with the extreme diameter of the segments of circles, B B, Fig. 210. No other lines in this case will be required, because the rod ends, having been turned in the lathe, give the machinist two true faces whereby to set the rod at each chucking. If the rod ends are not welded to the rod, the better plan is to have one of the broad surfaces on each rod end surfaced up in a planing machine, and to then perform the marking out on the surfaced faces. The marking out should be made about true with the stem of the rod, as shown in Fig. 211. The surfaced face is to be set, by a square, to a right angle to the marking-off table face; and the center line, A A, of the stem is found from the body of the stem, and carried from end to end of the forging as a guide to set the work by, the lines, B B or C C, being too short to serve the purpose. These latter lines are struck equidistant from A A. The line, D, should be struck with a square resting on the marking table, and any surplus metal should be taken off the end face rather than out of the corner where the butt joins the stem; because it is easier to take the metal off the end than out of the shoulder. The round corners need not be marked, it being preferable to make a gage to shape them to. The edges thus marked being shaped off, the thickness of the butt end may be marked off by a scribing block, the planed surface of the butt end lying flat on the marking table. The strap should first have one face surfaced, and then a center face should be placed between the jaws, being made just sufficiently tight to be held, and not so tightly as to sensibly spring the jaws open; otherwise, while the thickness of the jaws would be marked off correctly, the width

Fig. 211.



between them and their outside diameter would be too small when finished. The strap should then be placed on the marking table, and marked as shown in Fig. 212, the lines, A A, B B, and C C, being marked off to the required widths apart and equidistant from the center line, marked across the center-piece and across the crown of the strap, at D E. The center of the center piece having been obtained from the inside of the jaws, and carried across, at D E, after the strap is set upon the table with the inside faces of the jaws parallel with the face of the table, the width between the lines, A A, should be marked less than is the width of the block end on which they fit, for the following reasons: A connecting rod strap will, by reason of its shape, spring open between its jaws very easily indeed; and were the width between the jaws made the same as that of the block end of the rod, the strap would fit very loosely to its place. It is therefore necessary to make allowance for this in the width between the jaws of the strap, making them narrower than the block end of the rod. The amount of this allowance depends upon the size and stoutness of the strap, an ordinary proportion being about one sixteenth of an inch to a strap five inches wide between the jaws. This amount of allowance will enable the strap to spring over the rod end, and be a good fit, that is to say, not so tight but that it can be easily pulled off by the hand, and not so loose as to fall off of its own weight if unsupported. Then, again, any ordinary amount of metal removed in fitting the strap to the rod end will not seriously affect their fit together. Now it is obvious that, if the rod end faces on which the jaws of the strap fit are made parallel to each other, the strap, in being sprung on, would spring open so that its jaws would only touch the block at its entrance end, the end of the jaws standing open from the block end. To obviate this, the block end faces, B B, in Fig. 211, are made slightly taper, that is to say, about one thirty second of an inch or rather less in a length of six inches, the diameter of the end being the smaller. It is not necessary to mark so small an amount of taper in the marking, it being sufficient to run the center punch dots a little inside the line at the end of the block on each side. The lines, A A, in Fig. 212, representing the inside jaw faces, should also be a little taper, first to allow of fitting the strap



to the block end, and next to make the fitting of the brasses into the strap an easier operation. It is obvious that, if the inside jaw faces of the strap are parallel with each other, so soon as the brass is reduced to the size of the top of the strap, it will slide clear down to its bed; whereas, if those faces are made a little wider apart at the open end than at the crown end, the brasses, after entering at the open end, will have metal sufficient to be taken off them before being let down to the crown to permit of their being fitted nicely to the strap. For these reasons, the faces of the strap, A A, in Fig. 212, are made wider apart, in the proportion of nearly one sixteenth of an inch of taper to a strap having a jaw twelve inches long. The line, D, in Fig. 212, representing the amount of metal to be cut out of the crown of the strap, should only need that sufficient metal come off to allow that face to just true up: because it is an awkward face to operate on, and it is much easier to take any surplus metal off the outside crown of the strap, as represented by the line, E, in Fig. 212. The lines, F F and G G, are marked at the requisite distance from the crown, D, of the strap, with a square resting on the face of the marking table. The round corners and curves are marked off with the compasses, using the blocks of wood shown in our lesson on marking-off a double eye, previously given. The finishing, however, of such corners, both in the machine and in the vise, is usually done to a small sheet iron gage. Such corners can, it is true, be cut on a slotting machine table to a correct curve without the use of a gage; and there are many shaping machines with special attachments for the same purpose. Slotting machine work is, however, comparatively a very slow process; and in most cases it is found, in the end, more expeditious to shape out small corners with the cross and the up-and-down feed of the machine than to bother with such attachments.

Useful Recipes for the Shop, the Household, and the Farm.

To clean Britannia metal, use finely powdered whiting, 2 tablespoonfuls of sweet oil and a little yellow soap. Mix with spirits of wine to a cream. Rub on with a sponge, wipe off with a soft cloth, and polish with a chamois skin.

The best way to clean the inside of old iron pots and pans is to fill them with water in which a few ounces of washing soda is dissolved, and set them on the fire. Let the water boil until the inside of the pot looks clean.

To remove freshly spilt ink from carpets, first take up as much as possible of the ink with a teaspoon. Then pour cold sweet milk upon the spot and take up as before, pouring on milk until at last it becomes only slightly tinged with black. Then wash with cold water, and absorb with a cloth without too much rubbing.

Scorches made by overheated flat irons can be removed from linen, by spreading over the cloth a paste made of the juice pressed from two onions, ½ oz. white soap, 2 ozs. fuller's earth, and ½ pint vinegar. Mix, boil well, and cool before using.

Brown and black are the only fast colors in book-binding cloth. Red, green, and blue are the next nearest to fast colors. In calf binding, yellow or tan is the only color that will not fade. It wears best. Blue calf wears and rubs white. Purple and wine colors fade very quickly if exposed to light. Claret is greatly superior to the last named, and is nearly fast.

The following recipe for whitewash is recommended by the Treasury Department to all lighthouse keepers. It answers for wood, brick, or stone. Slake about ½ bushel unslaked lime with boiling water, keeping it covered during the process. Strain it, and add a peck of salt, dissolved in warm water, 3 lbs. of ground rice put in boiling water and boiled to a thin paste, ½ lb. powdered Spanish whiting, and 1 lb. clear glue, dissolved in warm water; mix these well together, and let the mixture stand for several days. Keep the wash thus prepared in a kettle or portable furnace, and when used put it on as hot as possible, with either painters' or whitewash brushes.

The best time for felling timber is when the tree contains the least sap, and that is the case in midsummer and midwinter. In general, all soft woods, such as elm, lime, poplar, and willow, should be felled during winter. Oak, alder, beech, and pine are better cut in summer.

A Useful Invention for Weavers.

Chambers' Journal has a brief account of Barker's patent self-acting punching machine for repeating Jacquard cards. In the ordinary machine, a skilled workman must be employed during three weeks or a month to fit it up and get it in working order. The new machine, which can be packed in a small box, is always ready for working, and will prepare from 12,000 to 20,000 of the perforated cards in a day while the old process will not produce more than 1,200. Another advantage consists in the rapidity with which changes of fashion may be followed. A manufacturer will bring out new designs for each season; and if any of them meet with success, he will frequently be able to take large orders, if he can execute them with dispatch. Aided by the new machine, he can get cards for a large number of looms in a day or two, instead of being weeks over them as in the old system, and can thus start his looms quickly and send his goods into market in time for the season.

American Quicksilver.

Mr. J. B. Randol, general manager, gives the production of the New Almaden mine for the year 1875, in flasks of 76½ lbs. each, as follows:

Months.	Flasks.	Months.	Flasks.
January	850	July	1,220
February	800	August	1,100
March	1,033	September	1,200
April	850	October	1,250
May	1,005	November	1,700
June	1,050	December	1,500
Total			13,648

The total product of the mine for 1874 was 9,084 flasks, making the increase this year 4,564 flasks, or nearly 50 per cent.

Eating Rats.

An English contemporary suggests that the health of sailors and the comfort of life on board ship would be promoted if the practice were introduced of eating the rats which swarm in most ships. There is really no reason why rats should not be eaten as well as rabbits and squirrels. They are clean feeders, and extremely particular as to keeping their bodies free from dirt. Rats which have existed in the hold of a grain-carrying ship might be a toothsome delicacy.

A Huge Clock.

The celebrated clock at Westminster (London, England), has 400 square feet of dial surface. The minute hands are 11 feet long. Although the hands are all counterpoised, the entire weight of hands, counterpoises, tubes, and wheels which has to be moved at every beat of the pendulum is not less than 1½ tuns. The going weight is 1¼ cwt., and the clear fall is 170 feet. It takes five hours to wind this clock up by hand. Huge as the great machine is, it shows an error of less than 1 second on 83 per cent days in the year.

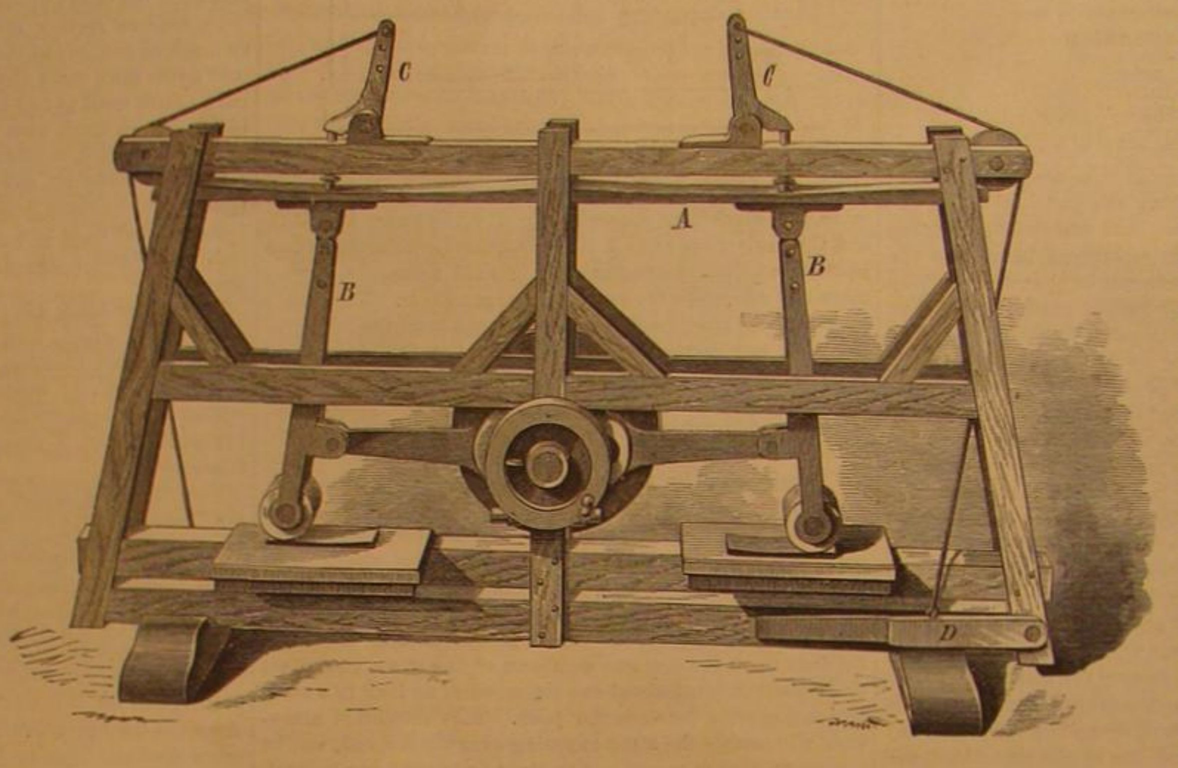
IMPROVED LEATHER-DRESSING MACHINE.

The annexed engraving represents a novel machine, designed to dress leather by the pressure of moving rollers. Either of these rollers may be adjusted or thrown into or out of action at will, independently of the other, and each has an independent depressing device, by which more or less force can be applied.

The apparatus consists of a main frame, in the top of which there is mounted a spring bar, A, which is supported only at its ends and at its middle. To the under side of this bar are hinged the upper ends of two hanging rods, B, on the lower extremity of each of which is attached a roller. These rollers work over the face of curved stationary beds, as shown, and their rods are actuated by connections from two eccentrics or equivalent devices, driven by a transverse shaft. In the top of the frame are two sliding pins, which are pressed down upon the spring bar, A, by the short arms of the elbow levers, C. Cords from the long arms of these levers lead down to foot levers, one of which is shown at D. When the machine is in operation the two rollers are carried to and fro above the beds, being suspended clear of the same in order to permit the introduction and adjustment of the leather. The attendants, after placing the latter, bring down the rollers, with more or less force, by pressing the treadles with their feet.

The two rollers always move in opposite directions, so that the strain and reaction caused by the change of direction or movement of one is overcome by the other. They may be very easily governed, and their pressure regulated without interfering with the continuous action of the machine.

Patented January 4, 1876. For further information, address the inventor, Mr. W. H. Rosensteel, Johnstown, Cambria county, Pa.

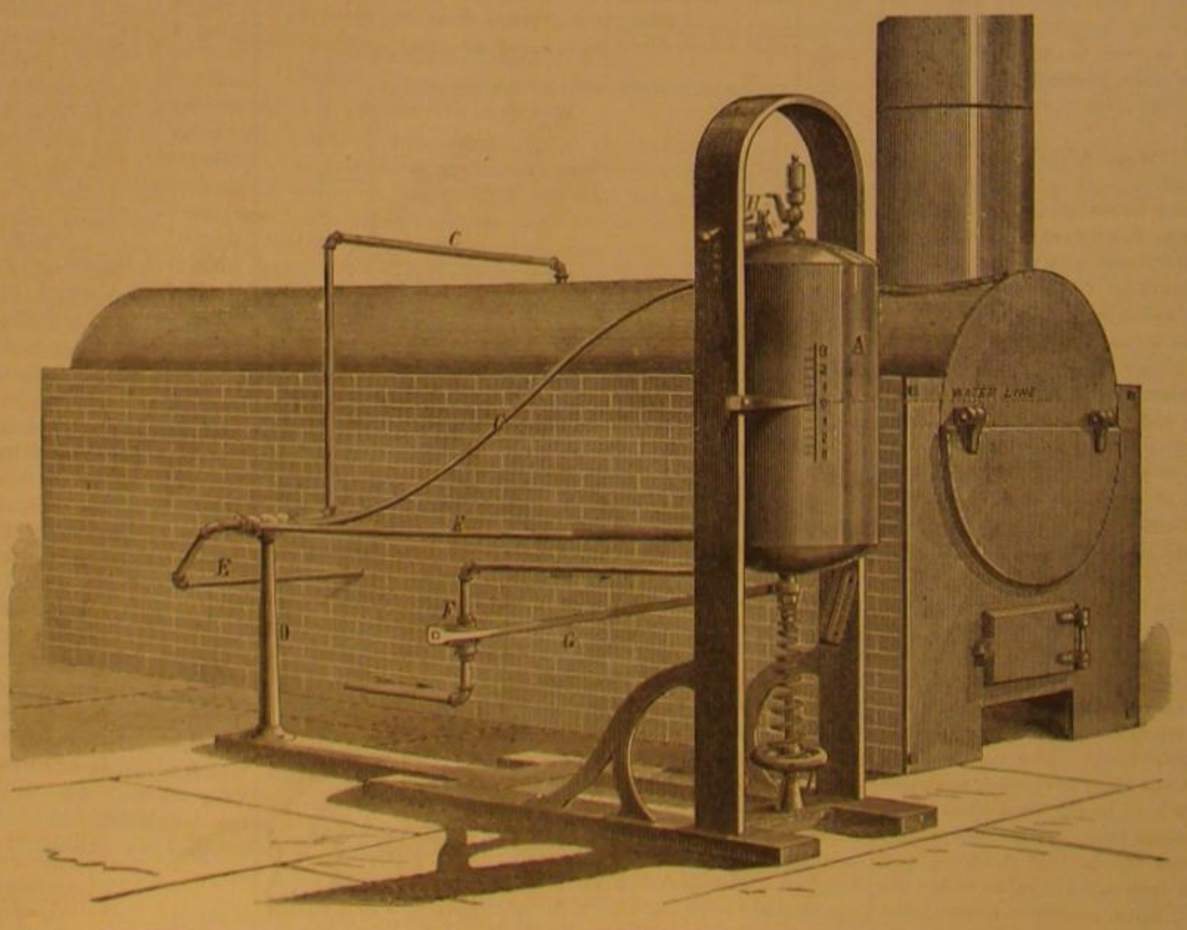


ROSENSTEEL'S LEATHER-DRESSING MACHINE.

WATER REGULATOR AND INDICATOR FOR STEAM BOILERS.

We illustrate herewith a new automatic apparatus for regulating the supply of feed water to a boiler so as to maintain a constant level therein, and which also is arranged to sound an alarm whistle in case of the supply falling short. The essential feature of the device consists in a tank communicating with the boiler, and in which the water stands at the same level as in the latter. This tank, with its contents, is balanced by an upward acting spring; and therefore, when said contents are increased or diminished, the fact is indicated by the falling or rising of the tank, plainly shown upon a suitable index. The movement of the tank governs the valve which admits water to the boiler.

In the annexed engraving, A is the tank, which travels in curved guides in the U shaped frame. It is supported by the strong spiral spring shown, the tension of which may be regulated by the hand wheel, B. C is a pipe communicating with the steam space, and passing over an elbow on the stand, D. E leads from the water space, and is similarly connected with the stand. Both of these pipes, by this arrangement, readily turn on the elbows as the tank rises and falls. They are continued, as shown, from the stand, D, respectively to the upper and lower portions of the tank. Consequently, the water in the tank will always stand at the same level as that in the boiler. F is the feed water pipe leading into the latter, and having a valve, to which is attached a lever, G, which is secured to the lower part of the tank. A pointer is fastened to the U frame and rests near a graduated scale on the side of the tank, so that, when the latter rises or falls, the distance it has moved may be readily observed. The zero of this scale corresponds to the proper water level (dotted line) in the boiler.



COOK'S WATER REGULATOR AND INDICATOR FOR STEAM BOILERS.

When the water rises above the water line, the increased weight will cause the tank to fall and operate the lever wrench, G, and so shut off some of the water. When the supply in the boiler falls short the diminished weight in the tank will allow of the rising of the latter and the operation of the lever in the opposite direction to let on the water, so that the boiler will thus be fed uniformly.

At the top of the tank is situated a valve lever, which is to be fastened under a hook when the valve is closed. Should the feed pump cease, from any cause whatever, to do its duty, the tank will rise, and a tripping rod, H, suitably adjusted in the U frame, will trip the hook and so release the valve lever, which, by the action of a spring, will fly up and so open a valve leading to a whistle. The latter then sounds until the pump again resumes its proper action.

Patented through the Scientific American Patent Agency, November 9, 1875. For further information, address the inventor, Mr. Dexter Cook, Elmira, Fulton county, Ohio.

Spontaneous Generation an Impossibility.

Professor Tyndall has lately read before the Royal Society a very important paper "On the Optical Department of the Atmosphere, with reference to the Phenomena of Putrefaction and Infection"—a lengthy title, says the *English Mechanic*, but one which does not adequately convey an idea of the subjects treated. It has been known for some time that air might be rendered free from floating particles by passing it through fire, acids, or cotton wool; and the Professor showed, not very long ago, that air thus purified will not transmit light, and a glass chamber filled with it remains dark, when placed in a beam of concentrated light, simply because there is nothing to reflect or scatter, or in other words to render visible, the light. Since then Professor Tyndall has discovered that air enclosed in a glass chamber and left undisturbed for three or four days deposits all the floating particles and becomes optically clear and dark to the beam of light. In this paper, Dr. Tyndall has apparently put the finishing stroke to the hypothesis of spontaneous generation, for he shows that solutions confined in chambers of optically pure air remain unaltered for months, while portions of the same or of similar solutions, when exposed to the atmosphere, swarm with bacteria in a few days. From his experiments, Professor Tyndall concludes that spontaneous generation is an impossibility, and that putrefaction and infection would be unknown in an optically pure atmosphere. We defer comment on these important conclusions until the full text of Professor Tyndall's lecture, with the record of his experiments, reaches us.

Rheumatism Recipes.

The *Journal of Health* has recently patiently collected all the recipes for rheumatism floating through the papers, and spreads them before its readers in the following: "Rochelle salts. Guaiacum. Rub with chloroform liniment. Sleep with your head toward the north. Nux vomica. Wear a chest protector. Nitrate of potash. Nitrate of sodium. Fowler's solution of arsenic. Sleep with a big dog, and give it to him. Kill a big dog, and, after taking out his intestines, put your feet where they came from. Magnetism. Galvanism. Bromide of ammonium. Iodide of ammonium. Mustard plasters. Spanish fly plasters. Bromide of potassium. Iodide of potassium. Lemon juice. Sage tea. Wear sulphur in your shoes. Hard rubbing. Oleate of mercury. Common soda. Capsicum. 'Radway's Ready Relief.' Wear silk. Wear flannel. Wear buckskin. Gin and hemlock. Reynolds' specific. Make a necklace of the knots produced by the sting of an insect on 'Golden Rod,' and wear it next the skin. Citrate of lithia. Exercise and keep it off. Keep as quiet as possible. Colchicum. Morphine. Water cures. 'Angel's' rheumatic gum. Pray fervently. Soft soap bandaged with flannel. Do not eat meat. Do not eat eggs or potatoes. Eat anything you please. Opium. Do not smoke at all. Smoke all you like. Take camphor. Drink nothing but beer. Do not drink anything but whisky. Do not drink anything at all. Do not leave the house. Take a ride out whenever you can. Carry a piece of alum in your pocket. Take Turkish baths. The Turkish bath is one of the worst things for rheumatism. De Soto spring water. Acetate of potash. Burdock seed. Bathe in hot water with pearlash in it. Bathe in cold water frequently. Do not bathe at all until you are nearly well. Catnip tea. Wrap fresh lamb's entrails around your neck, Drink brandy. Brandy is very bad for rheumatism. Sleep next to flannel. Go to Arkansas Hot Springs. Go to Doolittle Springs—to Saratoga, to Florida, to Bermuda, to the Sandwich Islands, to California, to the South of France, to Mexico, to the Azores, to South America. Wear a horse chestnut in your left hand breeches pocket. Wear a potato in the other. Take 'Constitution Water.' Take carbolic acid. Wrap joints with cotton, and cover with oiled silk. Glen Flora water. Get out on the prairies. High land is best for rheumatism. Balm of life. Magnetic salve. Rub with kerosene. Mustang liniment. Read Job. Put on hot poultices. Apply hop mashes. Do not swear. Put mustard plasters over the heart. Drink Friedrichshall bitter water. Seidlitz powders. Take a quart of alcohol with a dozen lemons in it. Take spirits of turpentine. Rub with spirits of turpentine. Slippery elm poultice. Electric oil."

A New Insecticide.

At a recent meeting of the Royal Horticultural Society attention was called to a new insecticide, which consists of camphor dissolved in methylated spirits to saturation, and mixed with soft soap to the consistence of cream. When diluted so as to be fit for use with a syringe, this has been found an efficacious substitute for fumigation in the case of mealy bug, scale, red spider, etc.

A VERY common reason for the failure of muck, when used as an absorbent or in compost heaps, is that it has already taken up all the water it can hold. It should therefore be thoroughly dried before forming into compost heaps. In building the heap, place muck and manure in thin layers, and use about twice as much muck as manure.

A CAUCASIAN WILD GERANIUM.

There are many geraniums, at present confined almost exclusively to botanic gardens, which, says *The Garden*, might be advantageously grown as ornamental plants in ordinary garden establishments; and among these, one of the most effective is that of which the accompanying engraving is an illustration. It is a beautiful Caucasian variety, named *g. platypetalum*. It grows wild in the Talish mountains, and is closely related to *g. sylvaticum*, from which, however, it only requires a superficial examination to distinguish it. It is of a stronger growth than that kind, and its flowers, which in color resemble those of *g. pratense*, attain, as will be seen by the engraving, which represents them in their natural size, much larger dimensions. This charming geranium is more especially valuable, both in large and small gardens, inasmuch as it is easily increased, both by division of the stem and by means of seed. In addition to this it is extremely hardy, and thrives in almost every kind of soil. It is, as will be seen, covered with soft, spreading hairs. The stem is erect and angular; the stipules broad; the leaves heart shaped and denticulated, and having from five to seven oboval obtuse lobes; the peduncles, which carry from two to three flowers, are covered with glandulous hairs, as also is the calyx, which has awn-like sepals. The petals, which attain double the length of the sepals, are two or three lobed; the stamens and carpels are slightly hairy, and the seeds glossy. The flowers, which are pendent previous to opening, remain erect during the time they are in bloom, a period lasting from May until July. Among all kinds of geraniums, *g. platypetalum* is one of the best for growing in clumps, in which it produces, when in full bloom, a striking effect, its flowers being large and produced in great abundance. It is a remarkably fine variety, and should always be cultivated where it is possible.

GERANIUM PLATYPETALUM.

Washing Flannels and Linens.

To whiten flannel, made yellow by age, dissolve 1½ lbs. of white soap in 50 lbs., soft water, and also ⅔ oz. spirits of ammonia. Immerse the flannel, stir well around for a short time, and wash in pure water. When black or navy blue linens are washed, soap should not be used. Take instead two potatoes grated into tepid soft water (after having them washed and peeled), into which a teaspoonful of ammonia has been put. Wash the linens with this, and rinse them in cold blue water. They will need no starch, and should be dried and ironed on the wrong side. An infusion of hay will keep the natural color in buff linens, and an infusion of bran will do the same for brown linens and prints.

THE EXTERMINATION OF THE PHYLLOXERA BY ALKALINE SULPHO-CARBONATES.

The sulpho-carbonates discovered by M. Dumas to be a specific against the ravages of the phylloxera, the parasitic insect which at one time bid fair to desolate all the vineyards of France, are formed by the combination of a mono-sulphide with the sulphide of carbon. In order to prepare them, the mono sulphide is dissolved in water or alcohol. To this solution the sulphide is added, and the whole is agitated, generating the sulpho-carbonates. Previous to their general application to vines, these substances were merely laboratory products, but recently in France they have been made industrially in large quantities and at low cost.

The alkaline sulpho-carbonates (potassium and sodium) are in the state of a dry salt, deliquescent and of a fine reddish yellow color; but it is often difficult to obtain them in that condition. More frequently they are to be had in a liquid state of solution, more or less concentrated, and marking from 33° to 40° B. The sulpho-carbonate of barium, on the contrary, is obtainable solid, and in the state of a yellow powder, sparingly soluble in water.

The useful application of the alkaline sulpho-carbonates to the cure of attacked vines requires, 1st, that all the infested surface may be treated; 2d, that the toxic action may be carried sufficiently deep in order to reach all the phylloxeras. These two conditions combine for the complete destruction of the parasite. It is necessary, moreover, that the remedy should act in the most economical manner. The best means of obtaining a perfect diffusion of the poison in the soil consists in the use of water as a vehicle. The quantity of water employed may depend upon the degree of humidity of the earth and upon expected rains; but the use of some water is necessary. From experiments conducted at Cognac, in France, and many times repeated throughout that country, it appears that, to apply the sulpho-carbonate solution, square excavations should be made in the soil, about 3 inches deep and 30 inches wide. As all the infested locality must be treated, these holes should be made sufficiently near together that the earth partitions between them shall become soaked after the liquid is poured in. The bottom of the excavation, it is hardly necessary to state, should be horizontal, so as to afford the best opportunity for the solution to infiltrate *uniformly* into the earth; and this should be borne in mind when the natural level is inclined. The holes should be brought up close to the base of the vine treated. The above done, about 2½ ounces of the sulpho-carbonate, at 40° B., is mingled with any quantity of water, in the ordinary watering pot or other vessel, thoroughly mixed, and the whole poured into one hole. Repeat this for every hole made, the area covered by the whole number of excavations of course being that under run by the roots of the vine. Then return the earth about the base of the vine and pour on plenty of fresh water, so that the poison will be forced deep down to all the roots. The annexed illustration, which we extract from *La Nature*, and which is copied from photographs, will give an idea of the effect of treatment with sulpho-carbonate of potassium. The two feet of vines shown formed part of a single attacked group, in which the parasite had existed for three years, and they had reached about the last stage of the disease. In March, 1875, one half of the selected group was treated with the chemical, the other left to its fate. In the treated portion, it should be noted that, out of 260 vines, 60 were already dead. Up to July the vegetation of the vines, without growing any weaker, had not improved; and it was not until the beginning of August that the leaves began to grow green and the shoots to elongate. Meanwhile, the vines not treated were daily perishing. In October, two average vines, one from each portion, were selected and reproduced, as stated, by photography, for the purpose of the present illustration. The vine on the left has very short branches, and its radicular system is almost destroyed; it may be considered, in fact, as dead. That on the right, which was in similar condition to the other before treatment, is evidently considerably improved, new shoots appearing and new roots being thrown out, so that it may be predicted that by next year it will have regained its former vigor.

EFFECT OF SULPHO-CARBONATES ON VINES.

The water necessary as a vehicle for the poison, in order to conduct it into the soil, is really a disadvantage; and besides, the most suitable season for the application of the sulpho-carbonates is during the rainiest period, when the earth is already soaked with water. Then, however, the quantity of water actually added as a solvent may be reduced to its minimum.

In order that the remedy may produce its best effect, there should be no delay in using it. Apply as soon as the disease becomes apparent. In the majority of cases, however, judging, as many will, from the harvest, few will have any fears of the malady during the first year of its existence; for it is now known that the plant, although strongly attacked, will still go on bearing; but during the second year, the disease will show its effects and require prompt treatment. Even then, however, if there be no further delay, the vines will not materially feel the ravages of the insect.

It is well to remember, in taking into consideration the cost of the chemical—and that, at present, is a rather indefinite matter—that the sulpho-carbonate of potassium is an excellent manure, and that it is quite probable that the excess of crop gained will largely repay the expense of treatment. It is reasonably certain that, in the sulpho-carbonates, the long sought remedy against the terrible vine disease has been discovered; but, on the other hand, with the exception of the facts above detailed, little is known or understood regarding its practical use, so that in that respect a promising field lies open for future investigators.

Radiant Heat as a Motor for Automata.

Among the many suggestions which have been advanced relative to the way in which automata may be caused to work without the aid of a confederate of the exhibitor hidden in the apparatus itself, some ideas offered by Professor Proctor, in an essay in his recently published "Science Byways," deserve credit for superior ingenuity.

He argues that, while it is possible that chess may be played by a machine, it is utterly impossible that cards can be, and hence an automaton like Psycho, supposing no person to be inside, is merely a curious deception. We have only to discover the trick which infallibly exists, and all is clear. One very plausible and novel way of performing the juggle, Professor Proctor finds in the invisible heat rays radiated from a concealed hot body. A metal globe filled with boiling water will retain sufficient heat to answer all the purposes of an exhibition of ordinary duration. This globe may be placed as near as possible to the automaton, of course out of sight of the spectators, and so arranged with reference to a concave mirror that its radiated heat rays are brought to a focus on the figure. A screen of blackened quartz, which would not obstruct the passage of the rays, might be used to hide the globe, or a lens of the same material might be employed to converge the rays, in lieu of the mirror. By a simple mechanical arrangement, a confederate located anywhere in sight of the exhibitor could so govern the mirror or lens that the focal point of the rays could be directed on any desired spot on a given surface of the automaton. The latter has before it thirteen cards, and its performance consists in lifting one of these cards at its proper turn during the game. This purely mechanical operation is not at all difficult to execute, since the movements are few and simple—involving only the turning of the body until the arm is in position to descend and seize the proper card. If thirteen buttons existed on the machine, by touching any one of which the apparatus would take a different position and then operate, the intervening devices (clockwork being the motor) could easily be imagined. The trick would be then to touch the button without detection, even under the closest scrutiny; and this is the operation which Professor Proctor proposes that the focussed heat rays shall perform. For buttons substitute thirteen thermo-electric batteries, any one of which will generate a current of electricity when heated even to a very small degree, and direct the heat rays on each at will. Then the one which the rays strike will, by its current, change a stop or otherwise affect the general mechanism, to make the figure take up the card to which that particular battery corresponds. Information is conveyed to the confederate, by any prearranged system of signals, from the exhibitor, who watches the game; and thus the automaton might be worked in a way to which even an examination of its interior would fail to give a certain clue.

Hanging Investigations.

Professor Haughton, of Dublin, has recently described some investigations undertaken by him with a view of discovering which was the most certain mode of death, the long drop or short drop in hanging. The results are that the most comfortable method of hanging is to be sure of a rope of sufficient elasticity, to place the knot under the chin with a running noose, and to drop about 10 feet.

The *Medical Times* says that the test employed for selecting the men for the British Arctic Expedition consisted in making each candidate stand with his bare feet on a cube of ice. Those who endured the longest were chosen.

The Uses of Aluminum.

When we consider the excellent qualities possessed by this metal, its color, its brightness, its unchangeableness in air and in sulphuretted hydrogen, that it is not injurious to the health and can be worked into any shape, it seems remarkable that it has found so little use, and that the great hopes, which greeted its preparation according to Deville's process, are so far from being fulfilled. The price of aluminum would be considerably less if it were made in large quantities, as it depends on the price of sodium, the manufacture of which could also be conducted more cheaply if there were a certain and large demand for it. But there is at present no such inquiry for it. The advantages of vessels made of aluminum are not so evident and conspicuous as to be able easily to overcome old habits. At the London Exhibition of 1862, numerous articles of aluminum were exhibited; the Paris Exhibition of 1868 and the Vienna Exposition of 1873 showed that the interest in this "silver from clay" had died out.

Aluminum made by Deville's process was used at first for ornaments and other *articles de luxe;* on account of its lightness the tubes of opera and spy glasses were made of it. In physical apparatus and all fine instruments where weight is an objection, aluminum replaces other metals with advantage. Saber sheaths and dagger handles have been made of it. The eagles on the flag staffs of the French army are about 4½ lbs. lighter since they have been made of aluminum. As the metal can be drawn out to the finest wire, it has been used for embroidery, lace, fringe, and other decorations. They have some advantages over the same articles when made of silver, being lighter, and they do not tarnish.

Nevertheless, the use of aluminum has, as we have said, greatly diminished. Aluminum jewellery is scarcely seen at the present day. Opticians still use it for spy glasses and the like. Recently it has been much employed for surgical instruments. In the *atelier* of C. Schmidt, in Berlin, a considerable quantity is consumed in the manufacture of splints.

Although there is no mistaking the fact that the high expectations, with which the appearance of aluminum filled the public mind, have not been fulfilled, yet the aluminum industry has a safe guarantee of its existence in the use of the metal for aluminum alloys, which are capable of the most extensive use on account of their excellent qualities.

Aluminum will alloy directly with most metals, generally with strong heat, which may increase up to the glowing point. Small quantities of other metals affect the properties of aluminum, while, contrawise, small quantities of aluminum change the properties of other metals.

The alloy of aluminum with copper, aluminum bronze, is of the greatest importance in the arts. According to Tissier, as little as 1 per cent of aluminum, added to pure copper, considerably increases its ductility, makes it more fusible, and gives it the property of completely filling the mold, making a dense casting, free from air bubbles. At the same time the copper becomes more capable of resisting chemical reagents, increases in hardness without losing malleability, and unites in itself the most valuable qualities of bronze and brass. The color of the alloy is almost a copper red.

A copper alloy with 2 per cent of aluminum is used in the studio of Christofle, in Paris, for works of art. It works well under the chisel and graver.

The true aluminum bronzes, namely alloys of 90 to 95 per cent copper with 10 to 5 per cent aluminum were first made (says R. Wagner) by John Percy, in 1855. They became generally known through the researches of Deville.

For the preparation of this alloy, perfectly pure copper must be employed. If to a quantity of melted copper there be added one ninth its weight of aluminum, the two metals unite energetically, with the evolution of so much heat that the crucible, if it be not exceedingly refractory, softens and sinks together. The bronze obtained is at first very brittle, but by frequent resmelting increases in strength and ductility; the right degree is determined by hammering out a piece after each fusion. As a rule, two or three refusions suffice. Probably the amount of aluminum sinks somewhat below the original 10 per cent. Aluminum bronze with 5 or 10 per cent aluminum possesses a color very like that of gold. The alloy with 10 per cent has the color of green gold, an alloy of gold and silver. The alloys polish beautifully, make perfect castings, and possess great strength: according to Anderson's experiments, an average of 75,618½ lbs. per square inch. They are also very flexible, and, at temperatures from a dark red heat to near the melting point, perfectly malleable. The castings are perfectly sharp, and can be worked more easily than steel. This bronze engraves nicely, is easily rolled into sheets, and offers greater resistance to the air than other bronze, brass, silver, cast iron, and steel.

These excellent qualities give it a number of uses. In the construction of physical, geodic, and astronomical instruments, it is far preferable to all other metals. In jewelry and articles of art and luxury, it is employed in large quantities. Many kinds of house utensils are made of it, and it is also adapted to journal and axle boxes. Gun and pistol barrels, as well as rifled cannon, have been made of it, and have done excellent service. At present the high price of aluminum bronze alone prevents its general use for arms. Morin (who has probably gone out of the business now) furnished these bronzes at the following rates: 10 per cent aluminum, $6 60 per lb.; 7½ per cent aluminum, $5.50 per lb.; 5 per cent aluminum, $4 40 per lb.

These prices are four or five times as tin bronze. In articles where the price of the raw material is of little consequence as compared to the value of the work, as in physical instruments and the like, the aluminum bronze is always to be preferred.

In England, kettles made of aluminum bronze are employed for making preserves and ices from acid fruits. Morin & Co. manufacture weavers' shuttles of bronze, which, of course, do not oxidize so readily as steel. Cambrien recommends this alloy for type casting. Type made of it can be used 50 times as long as those from lead and antimony. Hulot employs it for the bed of perforating machines for perforating postage stamps. Lange, in Glasshütte, Saxony, makes watch mainsprings of an alloy of 5 parts aluminum and 90 parts copper, or of 100 parts aluminum and 5 parts silver. The advantages possessed by such springs over steel springs are that they do not rust, are not magnetic, nor so brittle, but are very hard and elastic.

Aluminum alloys not only with copper but with most other metals. It does not unite with lead or with iron. R. Wagner therefore suggests the possibility of aluminum being employed for desilvering argentiferous lead.

An alloy of 100 parts aluminum and 5 parts silver can be worked like pure aluminum, but is harder and takes a fine polish. An alloy of 5 parts aluminum and 100 parts silver is almost as hard as coin silver, and has the advantage of containing no metal that is poisonous, or that alters the color of the silver. Such an alloy has been recommended for coinage, but in vain.

Small coins of pure aluminum, which can be stamped nicely, would be proof against mistake and deception on account of their lightness. Aside from the fact that the price of aluminum would vary with its increased product, another chief objection to its introduction into coinage is that the people cannot separate the idea of weight from the idea of a valuable metal.

Aluminum alloyed with 4 per cent of silver is used by Sartorius, of Göttingen, for making the beam of analytical balances, for which its lightness and unchangeableness especially fit it.

An alloy of 99 parts by weight of gold and 1 part of aluminum is very hard, but still ductile; its color resembles that of green gold; 90 parts of gold and 10 parts of silver make a white and brittle alloy.

The best alloy of aluminum and tin contains 7 per cent of the latter; it works easily, polishes nicely, but on attempting to cast it a portion of the tin separates from the aluminum.

An alloy with 3 per cent zinc is, according to Débray, harder than pure aluminum, but very ductile and brilliant.

A thousandth part of bismuth makes aluminum as brittle as glass, says Tissier.

According to the same authority, aluminum will unite with mercury only when moistened with caustic alkali. The amalgam is very brittle; the aluminum in it oxidizes easily in the air, decomposes in water, and in general acts like the metals of the alkaline earths. Jehn and Hinze have found that aluminum, when rubbed with leather impregnated with mercury, oxidizes to alumina.* Perhaps an aluminum amalgam was first produced.

With iron, aluminum produces an extraordinarily hard alloy. A compound of 24·5 parts aluminum with 75·5 parts iron is silver white, and does not rust in the air. On treating with dilute sulphuric acid, the iron dissolves and leaves the aluminum behind. A slight addition of 8 parts to 1,000 parts of steel imparts to it all the properties of the best Bombay wootz. Rammelsberg has, however, never found any aluminum in the samples of so-called aluminum steel analysed by him.—*Dr. Biedermann.*

SCIENTIFIC AND PRACTICAL INFORMATION.

THE SECRET OF EDUCATING FLEAS.

The editor of *La Nature* has been investigating fleas, with a view of discovering where, in those aggravating insects, resides the capability of being educated. His conclusion is radical; he says they cannot be educated, and that all the tricks so ingeniously exhibited by self-styled trainers are merely caused by the natural efforts of the insect to escape. Any one can make them draw minute wagons or go through similar performances, if care be taken to secure them to their work so that they cannot jump. It seems to us, however, that it must require considerable skill and ingenuity to hold the lively creatures while the securing operation is in progress.

ROYAL ROAST BEEF.

The traditional baron of beef, which since time immemorial has graced the sideboard of the king or queen of England on Christmas day, weighed this year 300 pounds. An English contemporary states that it was cut from a prize bullock bred from the choicest stock on the Royal Farm. Rounds of beef weighing 80 lbs. each, and spiced, were forwarded by the Queen, also in accordance with old custom, to the courts of Germany, Austria, and Belgium. The Queen's stock farm is said to be a model establishment. It appears certainly to be a productive one, judging from the fact that the Christmas sale of fat cattle netted Her Majesty the neat sum of $15,935.

THE ARTIFICIAL BUTTER INDUSTRY.

The perennial French artificial butter has turned up again, this time under the name of *beurrine.* It has recently been patented in France, and consists of beef suet mixed with from 15 to 20 per cent oil (kind not stated) and from 5 to 10 per per cent milk. This reminds us that at present there is an open field for artificial butter in this country, the so-called oleomargarin having gone out of existence. The material met with a fierce opposition from the butter and cheese trade and from dairymen generally, on the alleged ground that it was used as an adulterant and not as a *bona fide* production. There is no doubt but that it met with very little popular favor, and probably this, together with misfortunes in business management, threw the concern eventually into financial trouble. Several well known scientific gentlemen of this city were interested as stockholders, and upon them some of the pecuniary losses fall.

*Professor Henry Wurtz, of Hoboken, had previously discovered this property.

Curiosities at Central Park.

A reporter of the *Evening Post* has been the round of the American Museum buildings, including the Zoölogical Gardens, located in Central Park in this city. We extract the following interesting observations from his report:

The Museum and Zoölogical department of live animals, and the Park in which they are located, are among the most attractive places in which strangers visiting New York can spend a half day. The new building of the American Museum will soon be finished. Contributions of fossils and other curiosities are constantly being made by our citizens and travelers. A very beautiful series of polished calc spars from England, and a large number of ores, were given by Mrs. Riley, of New York, who has also sent, for the archæological department, a number of rare implements of ancient and modern date. The Museum received a very valuable Christmas present from its president, Robert L. Stuart, namely, the library of Mr. Carson Brevoort, which cost some $15,000 and includes a large number of works on ichthyology.

A BIBLICAL DEPARTMENT.

An interesting department has been established, in which are certain of the animals that are spoken of in the Bible—a department for Bible animals. This was begun by the reception from Beyrout, in Syria, of a collection comprising foxes, wolves, some reptiles, and birds, all from the Bible neighborhood of Syria. The specimens were preserved and stuffed by students of the Protestant College in Syria, which is under the charge of the Rev. Stuart Dodge.

ANCIENT IMPLEMENTS.

The American consul at Shanghai has very kindly sent for the department of archæology a collection of implements which represent the customs of ancient times. His object is to secure specimens of typical implements that have not become modernized. China and Japan, like every country opened to civilization, show many signs of innovation.

Lately he has sent a collection of the implements used in games. Dominoes in many shapes are among them, as are also playing cards, somewhat resembling those used at the present day.

THE CAT FAMILY.

Mr. D. G. Elliot, a naturalist of this city, who has long lived in Europe, engaged in publishing his large and valuable monographs on birds and mammals, has at various times given to the Museum valuable specimens. Being a gentleman of leisure and competence, he has devoted himself to the interests of this institution, and has secured many objects of great value which were offered for sale in the large cities of Europe. One of his latest gifts is a series of specimens of the cat family. Seven specimens of cats, represented by stuffed and mounted skins, that are included in the abovementioned work, have been given to the American Museum, and now are numbered among the elegant specimens in the case assigned to the cat family. One of the largest tigers ever captured is in this collection, mounted in the manner of those in the British Museum in London.

OTHER RECENT GIFTS.

A most valuable gift by Mr. Elliott is the collection of Madagascar monkeys or lemurs, mounted in the best style of taxidermy. Another exceedingly rare and valuable acquisition from the same source is the manatee, and a skeleton of another. The above are all mounted in the manner adopted at the British Museum.

Mr. Elliott has also given several thousand specimens of skins of North American birds, a collection made especially for the use of students in ornithology. These specimens are stuffed but not mounted; they are neatly laid out and placed in drawers to be placed in the ornithological rooms of the new Museum building. One room is arranged for a chemical laboratory, and another for work requiring lapidaries' tools, etc. Rooms are assigned for the various departments of conchology, geology, etc.

Dr. Rudolph Witthaus, of this city, has given recently a valuable cabinet, consisting of several thousands of species of beetles, in addition to his gift of foreign coleoptera which the Museum has already in its possession.

Mr. William Heins, of New Jersey, a prominent business man of New York city, has found time in his leisure moments to accumulate a very large collection of foreign and domestic butterflies of some thousand species. These will find place in the Museum as soon as the new cases are ready for them.

The fact that the new building of the American Museum is absolutely fireproof, both as an isolated structure and as one entirely built of stone and metal, gives confidence to those who desire to place objects there. Specimens are admirably exhibited also, which is another inducement, everything having a place worthy of its value.

THE ZOÖLOGICAL GARDENS.

The wild animals of the zoölogical collection in Central Park seem to thrive very well, though the accommodations are not of the best. Much interest has been felt in the success of the experiment of trusting the important duties of nursing the infant king of beasts to a dog. One of the lionesses of the Park collection gave birth to two healthy kittens, and from some unexplained caused failed to give them requisite nourishment. A fine large mastiff was at hand

and the young lions were offered to her tender care. The gentle mastiff immediately fondled them and assumed the charge, and has since, for a number of weeks, nursed them with affectionate attention. The kittens are getting large and clumsy, and, in a playful mood, sometimes caress their stepmother with unsheathed claws.

There are frequently unpleasant deformities in the lions born and bred here. Their legs are too short and are sometimes bowed very noticeably. There are a number of hyenas now in the Park collection, which were reared there. They are nearly black in color when they are born.

Beside the common spotted hyena there is a striped species in the collection, which is regarded as new to Science. This creature has a stiff mane, which is erected at every movement.

THE "HAY CRITTERS."

The young camel was one of the most interesting of the creatures born in the Park. Then there are Cape buffalo calves, and the beautiful Zebu calf, and the bison calf, and several others.

Since the completion of the large new house for ruminants, or "hay critters," as they are familiarly called, the exhibition has been very fine. The equine antelope is exceedingly curious, and is rarely seen alive. Some fine elands and two antelopes, called blessbocks, are also here. Another Indian antelope, with twisted, lyre-shaped horns, has just been obtained. There is the gnu, or horned horse, also, who belongs to the antelope family.

THE SEA LIONS.

A recent improvement in the treatment of the sea lions is worthy of notice. The pond in the rear of the carnivorium, which has heretofore been used for the great wading birds, has been surrendered to the seals and such creatures. This exhibition is now one of the most entertaining. There are often six or seven large sea lions here, and they fully enjoy the ample space. They play briskly with their fellows, dive and leap, plunge in at one side of the pond and shoot out at the other. They hobble about on land, chasing each other, presenting a most grotesque appearance. One seizes a piece of ice in his mouth and tosses it in the air, catching it adroitly as it falls; another vaults upon the bottom, beneath the water, and pulls under his fellow who is quietly sleeping on the surface. It is surprising to witness the agility of these creatures on land. They chase each other very briskly around the yard, leaping much as a puppy does in his attempts to caper.

Poetical Soap.

Messrs. Water and Oil
One day had a broil,
As down in the glass they were dropping.
And would not unite,
But continued to fight,
Without any prospect of stopping.

Mr. Pearlash o'erheard,
And, quick as a word,
He jumped in the midst of the clashing;
When all three agreed,
And united with speed,
And Soap came out ready for washing.

DECISIONS OF THE COURTS.

United States Circuit Court---Fifth District of Louisiana.

PATENT STEAMBOAT STAGING AND DERRICK.—C. K. CONVERSE AND OTHERS *vs.* JOHN W. CANNON AND OTHERS.

WOODS, Cir. J.:

The complainants allege that they are the assignees of a patent issued to one A. John Bell, dated January 22, 1861, for an "improvement in steamboat staging;" that they are also the assignees of two patents issued to one Hannibal S. Blood, the first dated June 7, 1870, being "a new and useful improvement in derrick or hoisting crane, and relating particularly to a means for avoiding the labor and delay incident to handling and manipulating heavy landing stages used on steamboats and water craft by manual labor," and the second being a patent dated March 26, 1872, for an "improvement in derricks;" that all of the inventions named in said three letters patent relate to the manner and mode of manipulating and handling stages used on steamboats and water craft for landing freight and passengers, whereby manual labor is, in a great measure, dispensed with, and great economy in the navigation of such vessels effected, as well as a large decrease of expense in the navigation and use of such vessels and water craft.

That the defendants, John W. Cannon and William Campbell, the first largely interested in the steamer Robert E. Lee as owner, and the latter being her master, are using upon said boat two several machines, which are substantially in their mode of construction the same as the machine described in said three letters patent.

The bill prays for a perpetual injunction against the defendants to restrain them from infringing upon the patents owned by the complainants by the use of said machines now employed by them upon the steamer Robert E. Lee.

The answer of defendants denies any infringement of the patents held by complainants, and claims that they use an apparatus invented by one John Perkins, and patented to him by letters patent dated May 7, 1872, which differs substantially and materially from the apparatus covered by the patents owned by complainants, and is not an infringement thereon. *

In passing upon the issue of infringement, the question to be determined is whether, under a variation of form or by the use of a thing which bears a different name, the defendant accomplishes, by his machine, the same purpose or effect as that accomplished by the patentee, or whether there is a real change of structure or purpose.

If the drawing introduced by the defendant constitutes a mechanical equivalent, in reference to the means used by the patentee, and if, besides being an equivalent, it accomplishes something useful beyond the effect or purpose accomplished by the patentee, it will still be an infringement as respects what is covered by the patent, although the further advantage may be a patentable subject as an improvement on the former invention. (Drummond, in Foss *vs.* Hubert, 2 Fisher 31.)

The material question is not whether the same elements of motion or the same component parts are used, but whether the given effect is produced substantially by the same mode of operation and the same combination of powers in both machines. (Story, J., in Odiorne *vs.* Winkley, 2 Gall., 54.)

In determining the question of infringement, we are not to determine about similarities or differences merely by the name of things, but are to look to the machines or their several devices or elements in the light of what they do, or what office or function they perform, or how they perform it, and to find that a thing is substantially the same as another if it performs substantially the same function in substantially the same way to obtain the same result. (Clifford, J., in Vincent Refinery *vs.* Mathiason, 2 Fisher, 602.)

The rule is, and so it has been settled, that if two machines be substantially the same and operate in the same manner, though they may differ in form, proportions, and utility, they are the same in principle. (Washington, J. in Evans *vs.* Eaton, 3 Wash., 449.)

As between a device conceded to be new and a device claimed to infringe, because an equivalent, the alleged infringer could not protect himself by showing that, although his device was the equivalent of the patentee's device in all its functions and in its construction and mode of operation, yet by other additional features it possessed other and further useful functions. Such a device, though an improvement upon the patented one, would be an appropriation of it. (Woodruff, J., in Burrem *vs.* Hall, Official Patent Reports, Vol. 1, 437.)

To constitute an infringement, the contrivances for the purposes in view must be substantially identical, and that is substantial identity which comprehends the application of the principle of the invention. (Page *vs.* Ferry, 1 Fisher, 229.)

It makes no matter what additions to or modifications of a patentee's invention a defendant may have made: if he has taken what belonged to the patentee he has infringed, although with his improvement the original machine or device may be much more useful. (Sprague, J., Howe *vs.* Morton 1 Fisher, 587.)

Applying these principles to this case in hand, there can be no doubt that the defendants have appropriated the invention covered by the patent of A. John Bell. That they have improved upon parts of the combination may be true, but they are using the idea first suggested by Bell and covered by his patent, namely, the handling of a steamboat stage by means of a rope attached to a derrick, through force applied by a power windlass.

The variations which have been made in the method of attaching the rope in the form of the derrick in the position in which the stage is placed on the deck are immaterial variations, which do not affect the question of infringement.

As the patent to Bell bears date prior to the use of stages by the Marine Brigade, or to the publication in Appleton's "Dictionary of Mechanics," the defense of want of novelty cannot be maintained. The averment that the device of Bell is not useful cannot be sustained.

All the law requires as to utility is that the invention should not be frivolous or dangerous. It does not require any given degree of utility. If the invention is useful at all, that suffices. (Cox *vs.* Greggs, 2 Fisher, 174; Hoffheim *vs.* Brandt, 3 Fisher, 218.)

The result of this view is that there must be a decree for complainants directing a perpetual injunction to go against defendants as prayed in the bill, and a reference to a master for an account of profits.

Supreme Court of the United States.

OCTOBER TERM, 1875.—PATENT SAWMILL.—CALEB IVES AND GEORGE B. GREEN, PLAINTIFFS IN ERROR, *vs.* MILTON A. HAMILTON, ADMINISTRATOR OF PALMER HAMILTON, DECEASED.—IN ERROR TO THE CIRCUIT COURT OF THE UNITED STATES FOR THE EASTERN DISTRICT OF MICHIGAN.

Mr. Justice BRADLEY delivered the opinion of the Court.

This was an action brought to recover damages for the infringement of certain letters patent granted to Hamilton, the plaintiff below, for an improvement in sawmills. The defendants pleaded the general issue, with notice of special matter, setting up several prior inventions, amongst others that of one Isaac Straub. The plaintiff's patent was dated the 5th day of December, 1865. *

The defendants insist that Hamilton's patent is defective for not clearly describing the position, perpendicular or otherwise, in which the curved guides should be placed: and that if any required position can be inferred from the patent it is a peculiar one, whilst the guides of the defendants' saw are inclined at a slight angle to the perpendicular. As to the alleged defect of the patent, there is nothing in the objection. The invention claimed is an improvement on an old machine; and it is properly taken for granted that the practical mechanic is acquainted with the construction of the machine in which the improvement is made; and nothing appears in the case to show that any peculiar position, different from that of sawmills constructed in the ordinary way, is necessary to render it effective and useful. The essence of the improvement has nothing to do with the precise position of the guides. It is a combination of mechanical means to produce a rocking motion of the saw. And this combination is just as applicable to guides that have a slight inclination as to guides that are perpendicular. We think that there is no ground for either branch of the objection. The description in the patent is sufficiently specific; and the inclination of the defendants' guides cannot exempt them from the charge of infringement.

The complaint made by the defendants, that the patent is defective in not stating the nature of the curve for the guides, whether that of a circle or of some other figure, in view of the subject matter of the improvement and of the diagrams annexed to the patent, are not sufficient to affect its validity. Any good mechanic acquainted with the construction of sawmills, and having the patent and diagram before him, would have no difficulty in adopting the improvement, and making suitable curves.

The conclusions to which we have come are decisive of the case. It is unnecessary to discuss in detail the different points made at the trial, or the several instructions asked. We have examined them all, and find nothing on which to base a judgment of reversal. If Straub's patent would have revealed anything to affect the validity of Hamilton's, the parties did not see fit to spread it on the record, and therefore we have no means of deciding that question.

The judgment is affirmed.

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED ISTLE MACHINE.

Guillermo Roberto Welke, Parras de la Fuento, Mexico.—The object of this invention is to produce an improved machine for making istle, or the fiber of the lechugilla, which is applied in Mexico to the manufacture of a large number of articles, as hammocks, sacks, ropes, nets, cotton bagging, wagon sheets, carpets, and similar objects. The invention consists mainly of devices for scraping the leaves, while being drawn by rollers through the scraping knives, which are made to yield to the thickness of the leaves. The leaves are placed between the scrapers up to a gage piece, and then carried with the scrapers toward the feeding rollers. Sliding and reciprocating scraping jaws are operated by suitable transmitting mechanism, by the forward motion of the scraper frame, for scraping off the ends of the leaves which are conveyed to a receiving platform, and dropped by the same to a receptacle below.

IMPROVED WIRE STRETCHER.

Seman Taber, Russel Taber, and Charles M. Morgan, Hesper, Iowa, assignors to Seman Taber, Darius F. Morgan, and Charles M. Morgan, same place.—This device is for tightening wires that have been strung up, and especially fence wires. A bent bar is held transversely with the wire to be tightened. The wire is passed between pins on said bar, and the latter is turned longitudinally with the wire. The wire is then passed into the slot of a drum secured to the bar. The drum is turned by means of a wrench, to give the desired tension to the wire, a pawl holding the drum securely in any position into which it may be turned.

IMPROVED ROTARY PUMP.

William O. Crocker, Turner's Falls, Mass.—There are two toothed pistons engaging the one with the other. The peculiar construction of the teeth of the pistons enables the said teeth to be made so small that at least one tooth may always be in contact with each abutment, while at the same time having sufficient water space. To each of the abutments are swiveled set screws, so that they may be adjusted at any desired closeness to the pistons. A vent chamber and a suction chamber are formed in each head upon the opposite sides of a line joining the shafts.

IMPROVED TACK MACHINE.

Charles P. Weaver, Norristown, Pa.—This invention relates to machines with two cutting jaws for making tacks or small nails, and consists in so combining the header lever with the crank pitman by a lever, pin, and link, that the power can be applied directly in the line of the work, thereby avoiding all lateral strain and dispensing with the usual long arms and crooked ends of the heading lever, and allowing the size and weight of tack machines to be reduced fifty per cent.

IMPROVED CAR COUPLING.

Peter C. Murray, Sloatsburg, N. Y.—This invention consists of a centrally recessed drawhead, with a stationary link attached thereto, that is coupled by the laterally sliding cross pin of the connecting drawhead, the pin being guided and locked in open or closed position by a side standard and pin rod.

IMPROVED GAS GOVERNOR.

David B. Peebles, Edinburgh, Scotland.—Between two half cases, made of cast iron, a flexible diaphragm is fixed, and a passage for the gas is made between the upper and lower chamber through the projecting part of the case. In the lower half a recess is made to receive a disk of metal not acted on by gas. In the center of this disk a hole is made, into which the conical point of a regulating screw is placed, so that, by moving it, the hole can be opened or closed. The top of the screw is surrounded by a bead forming a recess, into which wax can be run to receive a stamp for a seal. The valve, made of fusible alloy, is of a double conical shape, with a stem at one end. The other end rests in a step made in the head of the center screw, which keeps the metal disks to the diaphragm. The bottom of the burner tube acts as a valve seat, and by this arrangement the valve can be taken out for cleaning by unscrewing the burner tube, without taking the governor to pieces.

IMPROVED AUTOMATIC TELEGRAPH KEY AND REGISTER.

Lucien S. Crandall, New York city.—This is an improved automatic telegraph key and register, by which, it is claimed, the manual and mental labor in transmitting telegraphic signals are facilitated and simplified to a considerable degree, the working capacity of telegraph lines increased, and the accurate manipulation of the instrument acquired by the operator with little practice. The invention consists of a letter ring, which is divided along its circumference by insulated and non-insulated portions and separating recesses, to correspond to the characters of the Morse alphabet. A number of spring keys are arranged around the letter ring, and lettered alphabetically, to correspond with the Morse letters of the ring. A bridge at the end of each key forms, when the key is depressed, the contact of the letter ring with one of a series of needles radiating from a vertical shaft that is intermittently actuated by the magnets by a local battery. The letter ring and spring needles form the poles of the main line battery, and record the depressions of the keys by a relay magnet with an armature, having lever with recording stylus at one end, and stop pawl at the other end. The stop pawl releases a spring-acted slip wheel that throws a local actuating battery in circuit, which imparts, by two magnets with armature pawls, switch, and governor, intermittent motion to a motor wheel, connected by a partially insulated and non-insulated step with a recess and spring rider, by which the motion of the motor wheel and needle arms may be kept up after the main line circuit is interrupted, to register spaces in and between letters. The number of needle arms correspondends with the subdivisions on the letter ring and the number of teeth on the motor and slip wheels, to expose at any moment one of the needles to the action of a key. This correspondence between divisions of letter ring and number of needle arms, and of teeth on motor wheel, in connection with the intermittent motion of motor, gives a dwell at the points of magnetization and demagnetization of main line circuit. The closing of the main circuit by the key throws the local circuit into operation, which revolves the needle wheel until the local circuit is interrupted by the action of the hook pawl on the slip wheel, and the return of the needle through the recess of the letter ring.

IMPROVED MILLSTONE DRESSING MACHINE.

William B. Chase, Faribault, Minn.—This is an improvement in the class of millstone-dressing machines in which a pick or cutting tool is operated by a vibrating lever, and caused to travel over the face of the stone by means of pawl and ratchet mechanism. The construction is such that a greater or less degree of forward motion of the pick may be produced, and the operation of the same on the stone accurately adjusted and interrupted by the handle of the pick lever, the forward feeding of the pick being obtained by a screw turning lever pawl and ratchet mechanism.

IMPROVED LEVELING AND TRAMMING APPARATUS FOR MILLSTONES.

James T. Beckwith, Cameron Mills, N. Y.—This consists of a frame suspended from another frame, on which the stone rests, and is leveled by screws from below. On the suspended frame are screws, which, being adjusted in the frame when the stone is first leveled by its face, serve afterward to level the stone at any time without removing the runner. This lower frame serves for tramming the spindle. In addition thereto, a couple of plumb lines are suspended from an upper frame on the spindle through a lower one, by which the spindle may be trammed.

IMPROVED MACHINE FOR BORING AND WALLING WELLS.

Charles B. Stough, Monticello, Ill.—A wheeled frame supports a circular way, beside which is a toothed rim, which gives rotary motion to a horizontal shaft, which is mounted in a frame, the said frame being rotated by suitable power. An arrangement of rollers in the frame holds the auger shaft, which is rotated with said frame, and said rollers also allow the shaft to settle as the auger penetrates. As the auger enters, the soil passes upward to a case from which it is removed and raised to the surface by an endless bucket chain working on the auger shaft.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED SLED PROPELLER.

William H. Shelton, Jr., New York city.—The sleigh is provided at both sides with slotted guides, and fulcrumed lever handles slide loosely therein. Said handles have end claws that take hold of the ice or ground, and produce, by the weight of the body, the forward motion of the sleigh or carriage on the fixed lever fulcra.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED OILER.

George W. Parsons, Salisbury, Md.—The construction of this oiler is such that it may be overturned without spilling any of the oil, and the amount of oil discharged can be readily controlled. There is an ingenious arrangement of rack and pinion mechanism inside, which ordinarily keeps the nozzle shut, but which opens the same to a degree corresponding to the distance in which the bottom of the can is pressed inward.

IMPROVED STEAM RADIATOR.

George P. Jacobs, Brooklyn, N. Y.—This is a one-piece radiator tube, having four steam ducts surrounding the central air tube, said ducts being in pairs, the two of a pair being connected, but each pair being independent of the other. By this arrangement, in addition to the increased outer radiating surface, there is a large inner radiating surface, along which an active current of air is induced.

IMPROVED LEACH.

Marion P. Wolfe and Edwin M. Henkel, Crawfordsville, Ind.—This consists essentially of an ash receptacle and leach having an inclined and channeled bottom, and a top reservoir with perforated bottom to distribute the water and draw off the lye.

IMPROVED STREET SPRINKLER.

William Westerfield, New York city.—This is a piston-shaped valve located in the main pipe connected with the sprinkling tube. The pipe which leads water from the tank enters the main pipe, and as the valve is adjusted, one or the other side of the aperture of the former water is shut off or admitted to the sprinkler. This enables the flow to be governed more conveniently.

NEW AGRICULTURAL INVENTIONS.

IMPROVED CHURN.

James L. Sprague, Hermon, N. Y.—This invention includes propeller shaped paddles which draw the cream to the center of the churn, and through suitable apertures in which air is forced through the cream. Devices are added to prevent clogging of the cream at the corners of the churn.

IMPROVED GRAIN HEADER.

Charles K. Myers and John W. Irwin, Pekin, Ill., assignors to Peter Weyrich and C. K. Myers, of same place.—In this apparatus the cutter bar can be adjusted for cutting the grain higher or lower, and can be regulated to suit varying hights of grain. There are novel devices for moving the sickle bar, and various useful improvements in construction, tending to add to the general efficiency of the machine.

COMBINED SCRAPER, CHOPPER, AND DIRTER.

Arthur L. Spence, Alma, Ark.—This machine scrapes the cotton plants, chops them, and then, by means of plows, dirts them as it advances. The new feature introduced is a device in connection with the choppers which, should they strike an obstruction, allows them to stop their motion, while that of other parts of the apparatus continues.

Business and Personal.

Notes & Queries

J. H. P. can make a cement for mending rubber boots by following the directions given on p. 203, vol. 30.—S. A. G. will find that the fireless locomotive, described on p. 96, vol. 30, answers his description.—A. V. S. will find a description of the glass-tempering process on p. 402, vol. 32.—P. V. will find an excellent recipe for yeast on p. 183, vol. 33.—M. G. F. will find directions for hardening soap on p. 194, vol. 32.—J. J. M. and others, who inquire as to pisciculture, should address Seth Green, Esq., Rochester, N. Y.—J. A.'s query as to the relative motion of parts of a wagon wheel is answered on p. 298, vol. 31.—W. Y. Jr. is informed that we do not know the copying fluid he mentions.—J. F. M. and others, who ask as to the construction of special machines, should address the manufacturers.—A. R. W. will find a recipe for a deep black ink on p. 92, vol. 33.—W. & S. will find a recipe for a cement for filling millstones on p. 251, vol. 31.—O. C. will find a recipe for a waterproof whitewash on p. 408, vol. 24.—O. C., S. P. B., F. B. P., G. H. R., J. W. D. should consult the *Beekeeper's Magazine*, 14 Murray street, New York city.—J. W. C. will find a recipe for a good mucilage on p. 373, vol. 33.—H. H. B. will find a recipe for aquarium cement on p. 43, vol. 33.—J. J. R. will find some information as to galvanized iron water pipes on p. 218, vol. 25, and on p. 264, vol. 26.—F. J. R. will find a simple recipe for tanning hides on p. 147, vol. 30.—C. L. R. will find a recipe for invisible ink on p. 299, vol. 30.—H. B. will find a description of Professor Tyndall's respirator on p. 178, vol. 32.—G. A. McC. can convert his black ink into copying by adding a little refined sugar.—C. G. W. can repair his rubber life preserver by following the directions on p. 203, vol. 30.—J. A. will find a recipe for black ink on p. 92, vol. 33; for laundry blue, see p. 219, vol. 31.—S. R. S. will find directions for soldering of all kinds on p. 251, vol. 28.—W. L. D. will find directions for building a windmill on p. 241, vol. 32.—E. P. C. will find full directions for making colored fires on p. 165, vol. 24.—L. C. K. will find answers to his questions as to small boilers and engines on pp. 225, 257, vol. 33.—J. D. B. will the dimensions of the various gages of wire on p. 363, vol. 28. For the relative prices of gold and platinum, see p. 169, vol. 33.—J. C. will find a good recipe for baking powder on p. 123, vol. 31.—J. R. will find directions for scouring castings on p. 139, vol. 31.—W. C. can utilize tinned plate scraps by the method described on p. 319, vol, 31.—J. D. will find a description of Professor Draper's method of silvering glass on p. 267, vol. 31.—J. T. W. will find a recipe for furniture polish on p. 315, vol. 30.—W. N. will find directions for coloring photographs for magic lantern use on p. 390, vol. 30.—W. K. will find directions for laying out a sun dial on p. 409, vol. 29.—R. S. can prevent mildew on canvas by the method described on p. 90, vol. 31.—F. T. will find a recipe for shaving soap on p. 251, vol. 32. The type writer is described on p. 79, vol. 27.—S. N. will find recipes for Worcestershire sauce on pp. 241, 281, vol. 26. Galvanizing cast iron is described on p. 59, vol. 24.—M. G. can make condensed milk by the process described on p. 343, vol. 30.—D. Q. can separate silver from lead by the method described on p. 138, vol. 32.—J. N. can temper millpicks by the process given on p. 202, vol. 31.

(1) O. G. says: I have charge of a pair of engines at a coal shaft, and have had a great deal of trouble by the breaking of the teeth in the cog wheels, or rather in the sections of the cogs. The breakages generally occur at the starting and stopping of the engine. The engine is 11 by 25 inches, and our usual speed is 125 revolutions per minute. How can we prevent the accident? A. Make the width of the teeth greater.

(2) J. T. H. says: We cannot get speed enough from our main shaft to run a fan for a cupola. Which would require the most power, to increase the pulley on the main shaft or to use a a countershaft, to get the same speed? A. To use a countershaft.

1. I am making a small engine, 2½ inches stroke by 1¼ bore. Would ⅜ inch steam ways be large enough? A. This depends on the pressure. 2. Of what size should the fly wheel be? A. About 6 inches in diameter.

(3) H. C. S. asks: Is there any non-conductor that will not be affected by steam at 200 lbs. pressure? A. Yes, charcoal.

(4) D. H. asks: 1. Will plumbago serve to make good cores? A. Yes, if used with sand. 2. Can plumbago be molded at a core for an internal screw, so as to have a perfect thread when the iron or steel is cast? A. Not by itself. 3. What is put into pulverized plumbago or black lead to cause it to mold with facility? A. We are not aware of any substance for this purpose.

Can a good square thread of an internal screw, from ⅜ to 1½ inches diameter, be cast in iron or steel? A. No.

Is there any danger of a kerosene lamp exploding when the blaze is fluttering and shoots upwards two or three inches? A. Yes.

(5) N. H. C. says: R. R. & G. E. say that cut nails are made from bars of iron rolled into widths of the length of nails to be cut, and then they are cut crosswise. I say they are rolled in wide plates, then cut by shears across the end of the plates in widths of the length of the nail, which brings the nail lengthwise of the rolled iron. Which is right? A. You are.

(6) C. F. R. says: A pressure gage on a boiler indicates 15 lbs. Is that the pressure on a square inch of the inside of the boiler, or is the strain 15 lbs.+15 lbs., to balance the air driven out by the steam, =30 lbs., 15 lbs. of which only is available for working purposes. I hold that the latter is true. A. The total pressure is 30 lbs., and the available pressure 15 lbs., per square inch.

A tubular boiler, used to furnish steam to heat a church, has lost several tubes or flues from a sort of pinhole corrosion, the water side of the flues being very clean when taken out. I contend that the rain water is too pure and dissolves the iron away, thus weakening it, and that they should use well water, partially or even entirely, to retain their boiler longer. Am I right? A. Rain water is generally more pure and better for steam purposes than well water, and it will remove some deposits from boilers.

(7) T. E. says: I am making a wrought iron fence, which I intend to have galvanized; but I find that galvanizing will cost more than the fence. Do you know of any good substitute? A. No, not an effective one.

(8) J. N. P. asks: In putting in a heating apparatus for a greenhouse, we made rust joints with a composition of 2 ozs. powdered sal ammoniac to a keg of iron borings. Is that the best proportion? A. Sal ammoniac 1 lb., sulphur ½ lb., iron turnings 100 lbs., is the best proportion.

1. I notice on a locomotive a rod running from the cab to the base of the smoke stack, joined to a lever that runs into the smoke stack. What is it for? A. To open and close the blast pipe to assist the draft. 2. Suppose a locomotive be standing with no steam in the boiler, what is the quickest method to set the valve without removing the steam chest cover, there being no centerpunch marks? A. It cannot be properly done. 3. What is the quickest method of placing the crank of a locomotive on the exact center when she is standing on an incline? A. An answer to this question would require too much space for these columns. We may probably before long elucidate the question.

(9) M. H. C. asks: Will a rotary pump, running at a slow rate of speed, force a stream of water through a hose with a very small nozzle, without loss of power by the water striking back into the supply pipe? A. Yes.

(10) O. A. Jr. asks: In setting up motion with gearing say, from 1 revolution of driver to 36 of driven pulley with 6 gear wheels, is it best to divide the motion equally along the train, or to gain more motion on the first pair of gears? A. Gain most motion on the last pair of gears.

1. I am using best boiler plate iron for steam boilers for agricultural purposes, ¼ inch thick for shell, and ⅜ inch for heads. How much can I reduce the above thicknesses by using cast steel? A. Make the shell $\frac{3}{16}$, heads ¼ inch thick. 2. Will a boiler made of steel plates in above proportions last any longer than an iron boiler? A. Yes.

(11) T. S. asks: Is there a way to temper iron wire from No. 6 to No. 21? A. No, except by casehardening it.

(12) R. A. McC. says: 1. I wish to put a whistle on the roof of my elevator, which is 38 feet from boiler. Would a whistle work as well as at a shorter distance from boiler? A. The whistle would work well, but not as well as if close to the boiler. 2. Would felt covering on pipe be any help in regard to keeping lead pipe warm? A. Yes, felt covering would answer well.

(13) J. B. asks: Please let me know the simplest rule for finding the diameter of pulleys to run a machine at a certain speed: for instance, main shaft has 90 revolutions and pulley on machine is 14 inches diameter. What size of pulley will I require on main and counter shafts? A. Multiply the diameter of the driving pulley by the number of its revolutions per minute, and divide by the number of revolutions you require your machine pulley to run at, and the quotient will be the required size of the latter.

(14) A. S. says: My doctor pump runs from right to left, and the plungers and stuffing boxes wear to one side. I have examined the pump and found it to be correctly in line, and level. In order to put the wear on the opposite side, could I not set the eccentric of the cut-off round, so that the pump will run in the opposite direction, namely, from left to right? A. We do not think the alteration would affect the wear to one side if the parts are in line.

My partner claims that putting 3 or 4 pieces of wood in the furnace, and then putting on a heap of coal, prevents the falling through of the small coal, the grate bars being ⅝ of an inch apart. I claim that putting one piece of wood into the furnace, and putting a heap of coal on it, will prevent the waste better than his way: because in my way the coal will form a cake, which, when stirred up, will give a good fire, and thus save fuel, time, and labor. Please give us your opinion. A. If the coal cakes, either plan will answer.

(15) E. S. E. says: A practical railroad engineer sometimes dashes water into the furnace, with the result that the sulphur and offensive gas came out in the form of pure white steam. The great draft would make the furnace able to bear a constant jet of water. Can you give any reason why it would not serve as an extinguisher of the objectionable smoke, which now issues from the locomotives? A. The injection of steam into a firebox has been applied for the object proposed, with partial but not complete success.

(16) H. P. O. asks: Of what use is the air receiver on a double-acting steam pump? A. It increases the suction and makes it more uniform.

A friend says that steam at any temperature can be tested by applying a thermometer. I say the thermometer will not indicate the latent heat of steam, or steam above 212°. Who is right? A. You are.

1. We have two shafts sunk to a vein of coal, and a level driven from one to the other, a distance of 1,100 yards. The one shaft ventilates the other. The upcast shaft stands 100 feet higher on surface than the downcast. My boss says that, if there is 10 lbs. per square inch on the mouth of the downcast shaft, there must be the same on the top of the upcast. I say: No, there is not the same amount; for I assert that there is an amount of the pressure lost by friction in traveling. Which are you in favor of? A. You are right. 2. Is the current the same in each direction? A. No.

(17) J. D. B. asks: Is there any difference between the American screw gage and the American wire gage? A. Yes, and the American wire gages of various makers differ.

(18) C. B. R. says: Some time since a blacksmith was forging a large piece of iron, when some of the sparks came in contact with a piece of old lightning rod that was near the forge. At the instant of contact, there was a loud explosion, and a flash of fire by which an old man, sitting by, was severely burned. A part of the rod was turned blue and smelt strongly of sulphur. The explosive substance, whatever it was, seemed to come from the surface of the iron, which was a solid piece. It was on a clear day without any atmospheric disturbance. What caused the explosion? A. The spark was doubtless a globule of melted iron which, being thrown against the rod by blows from the hammer, naturally enough scattered in various directions. It is possible, also, that the rod was wet at the time.

(19) E. A. W. asks: Can you inform me how to place a chair on a table arranged to have endwise, sideway, and up and down motion, so that the chair will not partake of the motion of the table? A. It cannot be done.

(20) J. A. K. asks: A friend has made a kiln of bricks which are well burnt, but are easily broken, and are too soft to stand the test of time. What will make the best wash or coating for these bricks when exposed to the weather? A. If the bricks are soft and easily broken, they are not well burnt, and you will find it very difficult to treat them with any preparation that will enable them to take the place of well burnt brick. Linseed oil may prevent them from absorbing as much water as they otherwise might, and this will cause them to last a little longer.

(21) H. K. Sr. asks: 1. What is the best speed for a grindstone 5 feet in diameter, to grind plows? A. Run your stone at 300 revolutions per minute. 2. How many horse power should an engine have to drive such a grindstone? A. About 4 horse power.

1. Can you give me a good recipe for hardening plow mold boards? A. To 4 gallons of water add saltpeter 1 oz., sal ammoniac 1 oz., and salt ¼ lb. 2. Does "Wrinkles and Recipes" contain such information? A. Yes.

(22) E. T. H. asks: 1. I want to make a magnet to place in a fire alarm telegraph circuit. The circuit is composed of about 6 miles of wire, with 15 stations. Of what size shall I make my magnet? A. Make the coils of copper wire, and let the resistance be 25 or 30 ohms for each magnet. 2. In a late number of your paper, Mr. Sawyer says that it requires 10 cups of Grove's cells to heat a fragment of platinum wire. In a former number, in an illustrated description of an hydro-electric lamp, the illustration shows only 1 small cup. What is the smallest amount of battery power required to heat platinum wire to a red heat? A. That depends upon several circumstances. A single cell of bichromate battery (without porous cup) will heat from a quarter to half of an inch of No. 46 platinum wire to a white heat.

(23) H. C. E. asks: 1. Of what diameter should a steam whistle be for a boiler 30 inches in diameter by 48 inches high? A. About 2¼ inches. 3. Of what kind of metal should it be made? A. Use a good composition, say copper 80, tin 16, zinc 4 parts.

1. Are spur wheels used for connecting propeller shaft to engine shaft? A. Yes, sometimes. 2 Is a shaft of patent cold rolled iron 1½ inches in diameter strong enough for a propeller 18 inches in diameter, the shaft being 7 feet long? A. It is rather too small in diameter.

(24) A. H. T. says: I have constructed a Jamin magnet, but have failed in magnetizing it on account of its peculiar shape and form, not having been able to apply the electro-magnet to the surface of the steel ribbons. Wishing to construct a magnet of great power, I ask your advice how I am to proceed in magnetizing it. What power of battery, and what form of magnet am I to use? A. We think you should be able to charge it with a bar electro-magnet. Two or three large sized cells will magnetize the latter strongly if the coils are properly constructed.

(25) I. H. C. says: How can I make a battery that will give one a small shock? A. It will require a number of cells to give much of a shock. A small electro-magnetic induction apparatus, often termed a medical machine, will suit you better. For its construction, see almost any school book on natural philosophy.

(26) A. H. asks: 1. What amount of electricity is meant by 0·02 of a weber, and how is it ascertained? A. The weber is an electrical unit by means of which electricians are enabled to convey definite information regarding the strength of a current. Its magnitude is such that the unit of electromotive force, called a volt, divided by the unit of resistance, an ohm, equals one weber; 0·02 of a weber is the strength of current usually employed on telegraph lines to work the ordinary Morse relays. 2. Does the consumption of materials in a battery vary inversely as the resistance of the circuit? A. Yes, aside from local action in the battery. 3. What relation do they sustain in that respect? A. The less the resistance, the greater the action. 4. Would it be economical to insulate the return wire of a short telegraph line? A. No.

(27) T. C. M. says: In a sheet copper vessel, the sulphate of copper solution, after being allowed to stand for a few weeks, has deposited a hard, greenish coat, which prevents the working of the battery of which it forms a part. How can it be removed? A. We have never met with this in our

experience, and are at a loss to give the information asked for without more definite knowledge of the fact. Is there not some other reason for the exhaustion of battery power?

(28) H. M. says: Forty years ago a surveyor laid down a line due north with a compass; 25 years ago another surveyor examined the same line with a theodolite, and called it N. 14° E. Recently a third has examined it, and pronounced it N. 17° E. Can the discrepancy between the two last be explained without inferring error in one or other of them? They are both astronomical surveys. The last surveyor asserts a change in the magnetic meridian. Please explain what that means, and its bearing on this case. A. The magnetic meridian is the line in which a freely suspended magnetic needle places itself when in equilibrium. There are but comparatively few places where the astronomical and magnetic meridians coincide. The latter varies from year to year, but the reason for this does not seem to be definitely ascertained. There are also slight daily variations. These are generally supposed to be caused by the sun.

(29) S. R. says: I have made a trough battery to generate a current for an electric light. The cell or trough is 24 inches x 9 x 9, and the plates, copper and zinc, are dipped into the acid. 1. Will ¼ inch apart be enough to separate the plates? A. Yes. 2. Will slips of baked wood, covered with a solution of shellac and rubber, do to separate the plates with? A. Yes. 3. What should be the size of the conducting wires? A. No. 14 copper wire will answer. 4. How can the wires be connected to the plates? A. By solder. 5. Would such a battery be good for the purpose? A. Not very. 6. Will lead pencils do for the carbon points? A. Yes.

(30) M. C. asks: 1. What is the best method of ventilating a private house? A. Do not let your furnace man use the smoke flues of the rooms for heating flues, but provide a fireplace and flue for each room independent of the heating flues, and keep said fire flues partially if not wholly open. Provide a strip of plank 3 inches wide, of the same thickness as the lower sash of the windows and of a length equal to their width; raise the lower sash, put this strip under it horizontally and bring the sash down upon it; the fresh air will now enter the room at the meeting rails of the sashes without causing bad drafts in the room. 2. What kind of furnace will be most serviceable for heating such a house? A. The best kind of heater is a hot water furnace, the next best is a steam furnace, and the worst is a hot air furnace.

(31) J. H. F. asks: Which is the most durable red stone? A. The Belleville, N. J., brown stone is a very durable stone; the Connecticut brown stone is of the finest grain and most uniform quality.

(32) C. H. R. says: In trying Mr. Edison's experiments, as shown in your paper of December 25, I find I can get all the results which you state can be obtained with an ordinary relay; and in addition I find that, by putting this relay in circuit (battery is a five cup Callaud), letting the armature rest on the core, and grasping the negative post of the relay with a pair of pliers in the left hand, and breaking circuit at same post with wire held in right hand, I get a shock, and a spark precisely like that from the magnet, as in Mr. Edison's experiments. By making the hand wet, the shock seems greater. A shock and spark can be got by touching any part of the post or pliers; and by a quick motion, the sensation is much like a magneto-electric pulsation. A. The shock is caused by the extra current which arises from the induction of the battery current on itself in the coils. This current and the so-called etheric force are generally supposed to be identical. Possibly your magnet is not insulated from the surrounding coils.

(33) H. O. says: Having just fitted a house with black ash, will you kindly inform me of the best method of finishing it? Varnish will not do and French polish is too expensive. A. Give it a coat of shellac, and then a good coat of boiled linseed oil.

(34) J. and J. T. say: We are building a church, and a dispute has arisen about the proper shape of the elliptic ceiling. Please decide for us. The building is 50 feet x 32, with 12 feet posts. How far down on the post should the elliptic begin, and how high above the posts should it be in the middle? The strength of construction is with us a very important part. A. Your plan is defective in respect both to strength and to hearing. With a ceiling so low, you would do better to adopt an open timbered roof. You would require only three trusses; let the tie of these trusses consist of a beam 5 feet long at each end, supported upon ornamental brackets, and tied together with a 1¼ inch iron rod; let the principal rafters over these ties be arched from the projecting ends of the tie beams, and ornamented back of the arch; bring down an iron pipe from the point of the arch to cross the tie rod and fall below it and carry a chandelier; at the junction of the pipe and rod, secure one to the other, and cover the connection with an ornament. An arched ceiling is likely to cause an echo.

(35) O. A. Jr. asks: In a steam boiler whose shell is of 38 inches diameter, with a 23 inch flue running through it, 8 feet long, ⅛ of flue being in the grate and the balance in the firebox, how much effectual heating surface will there be? A. As ordinarily reckoned, the effective heating surface would be the surface of the flue in contact with the products of combustion, and half the remainder of the surfaces which these products heat.

What compound makes a good bushing for steam governor valves? A. We have known both hard brass and good cast iron to be used with satisfactory results.

(36) S. H. B. says: I want to build a skiff of common poplar planks about ¾ x 16 inches wide and 16 or 18 feet long. The boat is to be about 4½ feet wide, with two sets of rowlocks. I want it to run as fast as possible. Will you please state the way to build such a skiff? A. Probably some of our readers, who have constructed similar boats, can give our correspondent more useful information than any we can furnish. If so, we would be glad to hear from them.

(37) S. A. H. asks: What is the compressibility of air? In a tube of 1 square inch area and 1 inch deep, placed vertically, and closed at the upper end, how far would 15 lbs. pressure, *plus* the atmosphere, force water? A. If the temperature of the air is kept constant during the compression, the pressure varies inversely as the volume. You will find the principles relating to the expansion and compression of air in any modern text book on physics.

(38) O. T. says: I have a bent glass tube inserted into the flue leading to a boiler chimney. The tube is filled with water to a certain hight when the damper is closed: and when the damper is open, the water in one leg of the tube is depressed $\frac{7}{16}$ of an inch, and in the other leg is raised $\frac{7}{16}$ of an inch. The chimney is 100 feet high. Will you please give me a rule to obtain the velocity of the draft in the flue in feet per minute? A. We could not give you a formula from these data alone that would be very reliable. You will find considerable information bearing on the subject in Spon's "Dictionary of Engineering," vol. I, article "Anemometers."

(39) F. M. T. says: I am about to construct, of oak, a boat as follows: 56 feet long, of 8 feet beam, and 3 feet 6 inches draft. Diameter of propeller is to be 3 feet 6 inches, driven by two engines each of 7 x8 inches stroke, by steam at 100 lbs. pressure. Approximately, what speed will I obtain from her? A. If the boiler furnishes plenty of steam, you may reasonably expect to realize a speed of between 7 and 8 miles an hour in smooth water.

(40) A. H. N. says: I am about building a boat of the following dimensions: 11 feet long, 2 feet 9 inches wide, to draw about 1 foot water. I wish to propel her about 3 miles per hour by means of a twin screw, to be worked by hand. Please tell me the diameter, pitch, number, and size of blades necessary for such screws? A. Use propellers of as large diameter as you can conveniently attach, each with three blades. The pitch can be determined by dividing 400 by the number of revolutions per minute, which latter should be as large as can be obtained without introducing complicated gearing. This allows for a slip of a little more than 30 per cent.

(41) G. F. McI. says: Would it be safe and practicable to feed a boiler from the top with cold or hot water? A. It would be practicable, but not advantageous.

(42) A. C. asks: What is the best way of building a float for fowling purposes, large enough to hold two men, for use on salt water where there are waves from two to four feet high? A. It would be a good plan to make the boat very broad in proportion to its length, either decked over entirely with the exception of wells for the occupants, or provided with wide swashboards. We have seen lightly built cedar boats, about 7½ feet long and of 4½ feet beam, drawing 8 or 9 inches with two passengers, cat-rigged, with center boards. Such a boat would stand a very heavy sea when the mast was unstepped.

(43) R. I. C. says: I have a mill with a 40 horse engine driving a pair of 4 foot burrs. How much wheat should such rocks grind (making good flour) per day? A. The data are hardly sufficient for a good guess, and we would prefer to hear from you what you are doing. Perhaps some of our readers who have similar mills will also be kind enough to send us some account of their performances.

(44) J. V. S. asks: How is it that *minus* multiplied by *minus* gives *plus*, and *plus* multiplied by *minus* gives *minus*? A. According to the views of modern analysts, it is a conventional rule or definition. In many works on algebra, an attempt is made to demonstrate the principle, but it is generally faulty, and must be so, if the other view is the correct one. A good illustration of the modern treatment of the subject may be found in the chapter on "Negative Quantities," in Todhunter's "Algebra."

(45) J. L. W. says: We have many driven wells in Hamilton, Ohio, and find that the common gas pipe will not last more than a year in some, while similar pipes have been in wells for a number of years, and are *still* good. Even the galvanized pipe will not stand in places. The soil is gravel and clay: can you explain the cause? A. If the water has an acid reaction, you cannot prevent this corrosion. In such a case, use pipes lined with lead, tin, or porcelain.

(46) L. H. J. asks: What number of Callaud cells is necessary to run a telegraph line of 3 miles, ground return, using two instruments of low resistance? A. Twelve, if the grounds are good.

(47) R. F. asks: Why is it that the telegraph cable operators at Heart's Content, Newfoundland, can tell what messages are passing over the French cable that lands at the islands of St. Pierre and Miquelon, the cables being at least 200 miles apart at their nearest points? A. They cannot do so.

(48) C. E. A. says: I have tried the experiment of connecting my telegraph machine with an alarm clock (for the purpose of making the sounder go like the hammer bell in the clock) to wake me up. I connected one wire from the machine to the bell, and the other with the brass frame of the clock, to which, of course, was connected the hammer which strikes the bell. When the hammer strikes, it completes the circuit, on the same principle as a telegraph key and thereby make the sounder click; but it did not work at all. I have on an ordinary current, so that, when the operator at the other end calls me, it wakes me up. A. The arrangement is very simple and ought to work. Perhaps you have not made the connections properly. Test them by connecting a wire across from the wire leading to the frame with the one leading to the bell, and see if the armature of the instrument will respond.

(49) P. L. S. asks: What kind of gas comes from sewers? A. It consists principally of sulphuretted hydrogen and carbonic acid gases.

(50) A. C. H. asks: When the zincs of a galvanic battery are amalgamated with mercury, and then exposed to the atmosphere for some days before using them, does the mercury evaporate from the surface of the zinc? I notice that zincs under such circumstances lose their bright silvery appearance and become dull and leaden looking. A. No. The mercury remains there, and, if the zinc is brushed, will appear bright and silvery.

(51) J. H. S. asks: 1. What is the best way of renewing the strength in a carbon plate used in an electrotyper's battery? A. A carbon plate in a battery has no power capable of being renewed. You must renew the acid when your battery becomes weak. 2. What will prevent a deposit of copper from sticking on a brass plate? A. Cover the plate with black lead.

(52) G. V. says: A friend of mine owns a pasture of several thousand acres in Texas. There is no water on the premises except a pond. In dry seasons the pond gets dry; and the distance of the nearest running water being about four miles, it causes much trouble on the ranche. He is spending a great amount of money in having holes dug in the ground in different parts of the pasture, and thinks he will get water if he only goes deep enough. Is this so? A. Perhaps he will. Water was obtained in the Sahara desert by means of driven pipes.

(53) J. E. asks: I want a place in which to keep fresh fish, packed in ice, in barrels or boxes. What would be the best plan for a building, 12 feet square and 7 feet high, so that the fish would keep for 6 days in hot summer weather? A. The ice should be kept as much as possible in a solid mass. Construct a small ice house about 8 feet cube, and provide a basement under it in which to keep the fish. The whole should be tight like an ordinary ice house, say with the frame 10 inches thick and filled in with sawdust. But ventilation and drainage should be provided; and if a current of air should be made to enter at the top and to descend through the ice and out through the basement by artificial means, it would be better.

(54) F. & S. ask: How can we color glue white? A. Boil the glue in a little water and add a small quantity of alum finely pulverized; allow to stand all night and then separate from the precipitate of organic matter, etc. The Cologne glue is made from offal that has been treated with chloride of lime after the usual process of liming, and is thereby bleached. It is pale but very strong. Commonly there is no acid used in the process of manufacture of glue, except those (lactic, butyric, propionic) that constitute the active principle of the oak-bark liquor used to remove the last traces of lime from the materials before boiling. In the manufacture of fine glue from bones, large quantities of hydrochloric acid are used.

(55) J. C. F. asks: Is there any kind of white composition or cement that will render a wooden vessel impervious to rain and water, so as to keep butter or lard sweet? A. Use melted paraffin.

(56) C. J. H. says: 1. On p. 268, vol. 33, you give a recipe for making ink. How shall I manipulate the ingredients? A. Boil the galls (finely pulverized) in the water for about 2 hours, occasionally adding water to supply the loss by evaporation; then add the sulphate of indigo, and finally the spices. Keep the whole for about two months in a wooden or glass vessel, which should be occasionally shaken. Then strain into bottles for use. 2. Is the sulphate of indigo used as it is sold in the shops, or should it be neutralized? If it is to be neutralized, how should it be done? A. The indigo may be obtained, already prepared, from any dealer in drugs. It is sometimes called indigo carmine.

(57) G. A. H. asks: In your issue of January 15, you state in an article headed "Spiritual Photography" that a solution of sulphate of quinine on a background will be invisible to the eye, and will yet appear on the exposed plate. What strength of solution is necessary? A. Use a strong solution of the sulphate with a little tartaric acid.

(58) G. D. asks: How can I make a first quality hard soap from lye from ashes and tallow, with other ingredients to harden it? A. The fats, oils, etc., are saponified by boiling with caustic lye for some time. A sufficient quantity of common salt is then added to precipitate the soap from its alkaline solution; the soap is then pressed to remove superfluous moisture and to give it form, and finally dried. Most of the common yellow soaps usually contain resinous bodies, sand, borax, etc., in their composition.

(59) P. A. K. asks: How can kerosene stains be taken out of carpets? A. Sprinkle good dry pipe clay over the spots and pass gently over it a hot iron. Allow the clay to remain some time in contact with the carpet, and then remove by means of a good stiff brush. Repeat the operation if the first trial proves ineffective.

(60) C. M. D. asks: What quantity of ether should be used to dissolve 3 ozs. shellac and 1 oz. india rubber? A. India rubber is so slightly soluble in ether that to dissolve the quantity of rubber you mention would require an immense quantity of very pure ether. Cut your rubber into small pieces and dissolve it in 34 ozs. hot naphtha, by constant agitation; add to this the shellac in a very fine powder, and heat the whole with constant stirring until the shellac is dissolved.

(61) J. H. C. asks: I racked a barrel of cider off twice and then attempted to fine it with isinglass. After standing three weeks I again drew it off, and found the isinglass at the bottom, like mud, but the cider is not as clear as before. Is a quantity of the isinglass held in solution, and will it eventually fine down? A. It will probably clear after some time. You added too much gelatin.

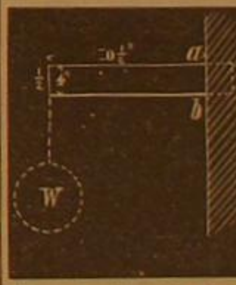
(62) T. A. H. asks: 1. Is not immersion in steam under heavy pressure one of the steps in the process of vulcanizing india rubber? A. No. 2. What amount of heat will india rubber or gutta percha, vulcanized or not vulcanized, endure when immersed in steam or water, without deterioration of its strength or elasticity? A. Caoutchouc melts in the air at a temperature of 392° Fah., with partial decomposition. It is reasonable to suppose that steam above that temperature would accomplish the same result.

(63) R. N. B. asks: Are there any adhesive properties in Irish moss? A. Yes, when it is converted into jelly.

(64) S. C. says: I have a side wheel steamer with a low pressure engine of 35 inches diameter and 9 feet stroke, cutting off at 12 inches travel of piston. It runs at 30 revolutions per minute. A vacuum occurs on the steam side of the piston when the piston has traveled 4 feet of the 9. Is there not a loss of power, and therefore of fuel, by this arrangement? A. If the engine exerts sufficient power, we do not see any objection in the arrangement, on account of the pressure in the cylinder falling below that of the atmosphere, as long as the positive pressure on the piston is less than the back pressure. It is possible, however, that the steam is for other reasons cut off too short for economical working.

(65) F. W. F. says, in reply to H. J. S., who asks as to pressure for compressing bales of cotton: In your issue of January 15, you say: "About half the pressure" or "same force." I think that you mean one half of 160 tuns when you say the same force. Do you not? Some weeks ago I asserted that a cotton press with a box 2 x 4 x 10 feet, containing 80 cubic feet, would require but ⅘ of the power that is needed by one 2 x 5 x 8 feet containing 80 cubic feet. Am I right? A. In the query referred to, the language is that of our correspondent H. J. S. We understood that the expression "half the pressure or same force" meant that there would be half the original pressure, or half the original force, or half of 100 tuns. We are sorry, however, if our answer influenced you at all in making the assertion that a press with a follower 2 x 4 would only require half the power of one with a follower 2 x 5, each compressing alike. Pressure is one thing and power is another, as we have frequently pointed out. Thus, in question 14, p. 43, when the bales were placed one on top of the other, the pressure required would be only half as great; but it would require to be exerted over twice the distance in the same time, to produce the same effect as when the bales were placed side by side.

(66) C. L. C. says, in reply to W. A. R.'s query as to the breaking weight of a bar of iron 10½ inches long, ½ inch wide, and 4 inches deep, supported at one end only with weight applied at outer end:



Let l=length =10½ inches, d= depth=4 inches, b= breadth=½ inch, W=weight required to break the beam, and c=constant=to 2,400 lbs. Thence we have, for the shearing strain, S, at the point, $a\,b$: $S=\frac{d^2 \text{ in inches} \times b \text{ in inches} \times \text{constant}}{4 \text{ times length in feet.}}$

$\therefore W=\frac{d^2\times b\times c}{4l}=\frac{16\times0{\cdot}5\times2400}{3{\cdot}5}=5485{\cdot}7$ lbs. This weight may only bend or cripple the beam, as the constant is the average breaking weight of a bar of iron 1 inch square and 1 foot long, supported at both ends and loaded in the middle. If the weight is equally distributed along the whole length of the beam, W will$=5485{\cdot}7\times2$ or $\frac{d^2\times b\times c}{2l}$

To derive the full strength, the beam must be so secured as to prevent lateral motion, which would tend to buckle the bar before the maximum strength was reached.

(67) E. H. S. says, in reply to J. D. H., who inquires how to thicken stove patterns: It can be done by first waxing the pattern, then taking strips of muslin cut to a proper width and laying them on the pattern, so that the edges will just meet, then pressing them into all depressions, and again waxing over. This may be repeated until the required thickness is reached. I have frequently tried this and never failed.

(68) W. E. C. says, in reply to J. M. S., who inquired as to the cause of bursting his main valve when steam is turned on: I burst a 4 inch valve once in the same way, and there was no ice in the pipe. Steam turned into a pipe containing water comes in contact with the water, a portion of the steam is condensed, and a vacuum is formed, drawing the water back. The steam pressure again thrusts it forward until it arrives at the end of the pipe or valve; and the water, being nearly a solid substance, strikes the valve with nearly the same force as a mass of iron driven with the same velocity. Of course the valve is not broken at the first blow; but the blows are repeated until the

water nearest the steam is heated. This also is the cause of thumping in steam pipes used in heating buildings. An outlet for the water destroys part of the force of the blow, although there is danger then if steam is turned on too suddenly.

(69) D. L. says, in reply to J. R. A., who asked how to cure cracked heels in horses: Take powdered gum camphor ½ oz., powdered gum myrrh 1 oz., sulphuric acid 1 oz., spirits of turpentine 1 oz., and lard 1 pint. Mix thoroughly, and rub on the affected limbs once a day. Wash the legs with soapsuds, and wipe dry before using. To prevent the affection, keep your stable and lot clean, and be sure that your horse is well groomed.

(70) H. S. J. says, in reply to J. M. H. Jr., who asks for a recipe for decalcomanie varnish: For preparing a fastening varnish for sticking the pictures to the object, take 5 ozs. Canada balsam (frequently called balsam of fir) and 1 oz. each of alcohol (90 per cent) and spirits of turpentine; mix thoroughly, and let stand a few days. For finishing, use white dammar varnish, or a varnish made of bleached shellac 2 drachms, dissolved in 10 ozs. stronger alcohol.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

X. X. Y.—All the specimens contain iron, but not in paying quantity.—J. S. B.—No. 1 is quartz sand, no emery or corundum. Sulphuret of iron is valueless.—A. M. S.—The boot lining is dyed with aniline green.—F. M. M.—The water is hardly entitled to the name of mineral, inasmuch as many natural waters contain as much mineral matter of a similar character, and are not supposed to be of a medicinal character.—R. F. A.—Your ferrotype plate is probably coated with a fine variety of japan varnish.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On the Witch Wand. By C.
On Eating Quails. By C. W.
On an Electric Shock. By J. C.
On Capital Punishment. By C. W. E.
On a Psychological Phenomenon. By A. Y. M.
On Poisonous Plants. By H. H.
On Bank Robberies. By M.
On Consumption. By I. R.
On Aerial Navigation. By E. R.
On Restoration of Life. By C. F. S.
On Puget Sound. By G. W. B.
On Thoughts on Astronomy. By W. C.

Also inquiries and answers from the following:

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[OFFICIAL.]

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8,932.—INKSTANDS.—E. W. Smith, Brooklyn, N. Y.
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